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COREFERENCE PROCESSING IN L1 AND L2

BY

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DISSERTATION

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ABSTRACT

In order to build a coherent representation of a discourse, the language processor must be able to resolve coreference relations between an anaphor and its antecedent. Theoretical and empirical evidence has suggested that discourse entities differ in their relative accessibility, and that this guides the choice of anaphors and identification of their referent (e.g., Ariel, 1990; Walker, Joshi, & Prince, 1998). According to the accessibility account, there is an inverse relation between the accessibility of a discourse entity and the degree of reduction of an anaphor used to refer to the entity. In seven self-paced reading experiments, this dissertation investigated the determinants of accessibility, the way accessibility interacts with referential ambiguity of anaphors, and the extent to which coreference processing in L2 is guided by the same factors that operate in L1 processing.

Experiments 1 and 2 (English) tested the prediction that an entity in the subject position is more accessible than an entity in the object position as measured by the relative ease of comprehending temporarily ambiguous pronouns disambiguated to the subject and the relative ease of establishing coreference using pronouns compared to repeated names for a subject antecedent. Another goal of Experiments 1 and 2 was to investigate whether the function of pronouns as a marker for the most accessible antecedent is influenced by their referential ambiguity. The results revealed a clear preference for interpreting ambiguous pronouns as referring to the subject. However, name anaphors did not result in additional reading time costs compared to ambiguous pronouns even in the subject antecedent condition. Given delayed disambiguation (Experiment 2), there was an overall preference for repeated names. These results suggest

that the processing of anaphors is influenced by the relative accessibility of discourse entities, but the ability of pronouns to coherently refer to accessible antecedents may be greatly modulated by the need to uniquely identify the referent of an anaphor.

Experiments 3 through 5 investigated the interpretation of null pronouns and repeated names as a window into how relative accessibility of discourse entities is determined in Korean. Accessibility was manipulated by varying the grammatical role (subject vs. object) and the order of mention (SOV vs. OSV) of an entity. The results consistently revealed an advantage for subject antecedents. Although not as strong as subjecthood, the results also indicated increased accessibility of scrambled objects: the on-line subject advantage was less pronounced in the OSV order when it was presented in felicitous discourse contexts, and off-line comprehension questions were answered more accurately when the anaphor had an object antecedent compared to a subject antecedent in OSV.

Experiments 6 and 7 examined the extent to which coreference processing in L2 English by Korean speakers is guided by accessibility and referential ambiguity considerations. Unlike native speakers, L2 learners showed an overall preference for repeated names in comparison to grammatically ambiguous pronouns, independent of the extent of referential ambiguity and the grammatical role of the antecedent. These results suggest that processing resources of L2 learners are limited. As a consequence of this limitation, L2 language processors face a particularly difficult challenge when having to take into account the multiple sources information needed to interpret pronouns.

Taken together, these results indicate that coreference processing is influenced not only by the accessibility of the antecedents but also by the referential ambiguity of

anaphors and the available processing resources of the processor. Implications are discussed in relation to theories of reference focusing specifically on what underlies increased accessibility of subjects and scrambled objects, why referential ambiguity matters, and why L2 coreference processing is different from L1 processing.

To my parents

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CHAPTER 1

INTRODUCTION

One of the interesting facts about human language is that we can use different expressions to refer to the same entity in the discourse, and the same expression can be used to refer to different discourse entities. Nonetheless, intuition suggests that we can interpret these expressions rapidly and without much effort. The question then arises as to how we achieve such a feat. This dissertation focuses on linguistic and processing factors that underlie how we resolve the intended referent of a referential expression.

One of the best-known explanations of reference processing in human language is that discourse entities differ in their relative accessibility, and that this aids the choice of referring expressions and identification of their referent (Ariel, 1988, 1990; Givón, 1983; Gundel, Hedland, & Zacharski, 1993; Walker, Joshi, & Prince, 1998). According to this account, the more reduced an anaphoric expression is, the more accessible its referent has to be in the mental model. Let us consider example (1).

1. a. Harry saw Ron at the cafeteria. He waved hello to him.
- b. Harry saw Ron at the cafeteria. Harry waved hello to Ron.

Many predictions follow from the accessibility-based accounts. In the first sentence of (1), ‘Harry’ should be more accessible than ‘Ron’ by virtue of being the subject of the sentence or being the first mentioned entity (Crawley & Stevenson, 1990; Gernsbacher & Hargreaves, 1988). In (1a), a reduced form such as ‘he’ should be preferentially interpreted to refer to the more accessible discourse entity, which is ‘Harry’ in this example. Finally, it is predicted that it should be less natural and harder to comprehend (1b), in which a less reduced form like a full noun is used to refer to an accessible entity (Gordon, Grosz, & Gilliom, 1993).

These general predictions raise several intriguing questions. The first issue concerns the potential ambiguity of pronouns. Is the general correlation between the degree of reduction of referring expressions and the accessibility of their antecedent mediated by the ambiguity of pronouns? Obviously, (1b) is less ambiguous than (1a), but the accessibility-based theories predict, and intuition suggests, that (1a) is interpreted without difficulty and (1b) might be less natural than (1a). Under what circumstances are these accessibility-driven expectations mediated or overridden?

The second question relates to the quest for cross-linguistic universals and differences. What are the factors that influence the relative accessibility of discourse entities in different languages? For example, in Korean, the sentence ‘Harry saw Ron at the cafeteria’ can be presented in different word orders without changing the propositional meaning. If the object NP appears sentence initially via scrambling, does it become more accessible? Also, in Korean, null pronouns but not overt pronouns are productively used, which raises the question of whether null pronouns are interpreted following the same set of predictions generated to explain mostly English data, where pronouns are overt.

Accessibility-based accounts were basically motivated by observations of coreference processing in one’s first language (L1). The final question, then, concerns the extent to which processing in a second language (L2) is guided by the same factors that operate in L1 processing. Are there any processing patterns found only in L2 language learners that differ from those in native speakers?

The exploration of these questions is essential in obtaining a more complete picture of the way the language comprehension system handles anaphors, which plays an essential role in the interpretation of discourse. Without successful identification of referential links between linguistic expressions, we cannot knit related sentences into one coherent discourse representation.

Definition of Terms

This section provides a brief definition of some of the key terms that are frequently used throughout the dissertation: anaphor, coreference, and accessibility.

Anaphor

An anaphor, from the Greek word meaning ‘above carrying’ (Matthews, 1981) is an expression referring to another term in a sentence or discourse. Anaphors are often realized as lexical NPs, pronouns, reflexives, and ellipsis. Anaphor resolution is the process by which an anaphor derives its meaning by reference to an earlier, or antecedent, expression (Field, 2004). The antecedent can be a word, phrase, sentence, or a paragraph.

It should be noted that the above definition is different from the usage of the term in generative grammar, in which anaphor refers to reflexive and reciprocal pronouns that have local, c-commanding antecedents and are interpreted via the syntactic operation known as binding (Chomsky, 1981).

Coreference

Coreference arises when two linguistic expressions refer to the same semantic entity in the external world. Coreference can be established with full expressions (such as definite NPs) and reduced expressions (such as pronouns), and can occur both within and

across sentences. In addition, coreference relations can involve any grammatical category. Strictly speaking, coreference is distinguished from referential dependency, in which one linguistic expression depends on another linguistic expression for its reference (Yoon, 2003).

2.
 - a. Mary_i was swimming. She_i saw a fish.
 - b. John_i looked at himself_i.

In (2a), the pronoun ‘she’ has the same referent as ‘Mary’ but it is not referentially dependent on ‘Mary.’ In this case, the two are said to be in a coreference relation. By contrast, in (2b), the reference of the anaphor ‘himself’ is dependent on that of ‘John.’

While formal linguistics is concerned with purely syntactic conditions that determine whether one linguistic expression can or cannot enter into referential dependency with the antecedent, psycholinguistics has different scope and goals. With regard to scope, psycholinguistics is not limited to sentence-internal referential dependency but encompasses inter-sentential/discourse coreference. Referential dependency is not possible across sentence boundaries, and hence, the domain of interest in formal linguistics has been a sentence. Even within a sentence, reference resolution is not always guaranteed when we focus on pronouns: Principle B of the binding theory informs us which NP should NOT be considered as the antecedent of a pronoun in the binding domain, but it does not give guidance about where to seek an antecedent outside the domain, as (3) illustrates.

3. The boxer_i told the skier_j that the doctor for the team_{*k} would blame him_{i/j/*k}.
(from Nicol & Swinney, 1989)

Whereas syntax has focused on explaining what prevents referential dependencies involving a pronoun within a sentence, psycholinguistics goes beyond factors promoting

disjoint reference and attempts to explore factors leading to coreference within and across sentences (Gordon & Hendrick, 1998). The main goal in psycholinguistics is to explore the mental and psychological processes underlying coreference as well as referential dependency.

Accessibility

During language comprehension, people have to build mental representations of the characters and events in the discourse (van Dijk & Kintsch, 1983). In these representations, some information seems to be easier to access because it is prominent, salient, or in focus. The present study uses the term accessibility/accessible to refer to the property of information that makes it stand out in the mental discourse representation, without necessarily committing to the theoretical framework of Ariel's (1990) accessibility theory, which is reviewed in Chapter 2.

The Scope of the Study and Overview

Although there are different types of anaphors, and coreference relations can involve any grammatical categories and can span across multiple sentences, this study focuses on the interpretation of subject anaphors referring to an NP in a local discourse context during visual language processing (i.e., reading).


This dissertation is organized as follows. Chapter 2 reviews relevant theories of coreference, the psycholinguistic literature on reference resolution, and previous research on the acquisition and processing of anaphors in L2. Chapter 3 reports two experiments that examined the processing of pronoun and name anaphors in English by native English speakers, with reference to the role of accessibility and referential ambiguity. Chapter 4

outlines the relevant linguistic characteristics of Korean and presents three experiments that examined the processing of null pronouns and names in Korean by native Korean speakers. Special attention was paid to cross-linguistic differences as well as similarities in the way the discourse entities are ranked in the accessibility scale and in the way different anaphoric forms are processed. Chapter 5 consists of two experiments that probed the processing of English anaphors by Korean speakers of L2 English. The results are discussed in relation to relevant L2 theories of processing. Finally, Chapter 6 summarizes the findings of the study and discusses how these findings shed light on some of the central issues involved in the processing of coreference. The limitations of the study and future directions are also discussed.

THE PSYCHOLINGUISTICS OF COREFERENCE

Theories of Coreference

The notion of accessibility plays a crucial role in the discussion of how different forms of referring expression are produced and processed. Ariel (1988, 1990, 1996) proposed the Accessibility Marking Scale (1), according to which the degree of informativity of a referring expression is correlated with how accessible its antecedent is in the minds of the speaker and the listener.

- Low Accessibility (of the antecedent) High Accessibility (of the antecedent)
- 
- definite description, name, demonstrative, stressed pronoun, unstressed
pronoun, cliticized pronoun, extremely high accessibility markers (*gaps*, *pro*,
PRO, *wh* traces, reflexives, agreement)

7

anaphoric expressions are viewed as “accessibility markers” in this theory. Less attenuated markers such as names will signal lower accessibility in comparison to more attenuated markers such as *pro*, which is at the other end of the continuum. The former types are used to retrieve referents which are not prominent in memory, whereas the latter types are used to retrieve referents that are in the current focus of attention.

According to Ariel’s Accessibility Theory, the assumed accessibility status of an antecedent is determined based on distance, competition, unity, and saliency. First, the accessibility of the antecedent is negatively correlated with the distance between the antecedent and the anaphor. Thus, recent mentions should be linked with higher accessibility markers. This is in line with Chafe’s (1976) observation that pronouns are used to refer to entities still in focus of attention over short distances, and usually within a single discourse segment boundary, and nouns refer to discourse entities over long distances. Secondly, the accessibility of the antecedent decreases when it is in competition with other potential antecedents. The third criterion, unity, concerns whether the antecedent is within the same frame/point of view/paragraph as the anaphor; in contexts where these boundaries are crossed, low accessibility markers are found. The last criterion, which is most directly related to the research questions of the current study, is the saliency of discourse referents: discourse topics constitute the most salient entities. Ariel also includes other factors such as physical salience in the context of utterance, discourse participants’ speech act roles, animacy, and order of mention, as contributing to the saliency of discourse referents.

Regarding the degree of accessibility marked by a given referring expression, Ariel proposes three criteria: informativity, rigidity, and degree of attenuation. The lower

the accessibility marker is on the scale, the more lexical information it normally contains. We have null forms that are found at the rightmost end of the scale (1), while at the leftmost end, we have elements with a lot of lexical information such as definite description and name. Having a lot of lexical information themselves, lower accessibility markers are used as retrieval devices which refer to less accessible sources. On the other hand, high accessibility markers are empty in semantic content, and hence rely on highly accessible entities for their interpretation. Another factor influencing the degree of accessibility marked by a marker is rigidity, or how unambiguously it points to one entity. Rigidity overlaps with the informativity criterion to a certain extent, as lexically rich markers tend to be less ambiguous. According to Ariel, this criterion can be useful in distinguishing between names and definite descriptions and also between various names (e.g., first names are less ambiguous than last names). Finally, the degree of attenuation concerns how much phonological content a particular marker contains. This criterion makes distinctions between, for example, stressed and unstressed forms, and between shorter and longer forms.¹

¹ The criterion of attenuation is relevant in explaining the interpretive difference in examples like (a-b).

- a. Jane kissed Mary, and then she kissed Harry.
- b. Jane kissed Mary, and then SHE kissed Harry.

The pronoun is preferentially interpreted as coreferential with Jane in (a) and with Mary in (b), showing that accented pronouns mark a less accessible antecedent than do unaccented pronouns. Production studies support the view that unaccented tokens, both definite descriptions and pronouns, are more likely to refer to less accessible antecedents (Venditti & Hirschberg, 2003; Wolters & Beaver, 2001; see Arnold, 2008 for a review). It should, however, be noted that reference management is also greatly achieved by intonation and prosodic structures in spoken language (Frascarelli, 2007; Pierrehumbert & Hirschberg, 1990), the role of which is less-well understood in theories of reference.

Accessibility theory appears to make well-grounded predictions about the relationship between various types of referring expressions and the degree of accessibility of antecedents in discourse. Different languages may have different number of markers but the basic interdependence between the lexical information in an accessibility marker and the degree of accessibility of its antecedent is intended to be universal in the theory (Ariel, 1990). What does not clearly follow from the theory is how to weigh different factors that are argued to influence the accessibility status of an entity, which will be one of the main research agendas of the current study.

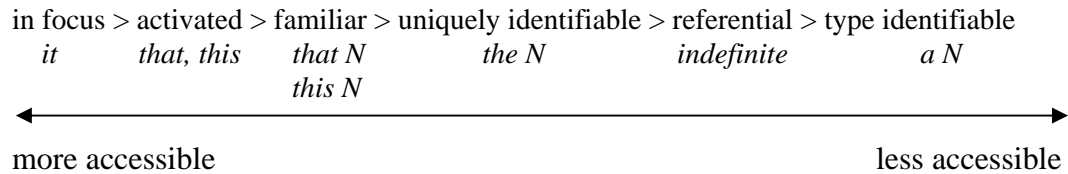
Givenness Hierarchy

Similarly, in a series of papers, Gundel and colleagues proposed the Givenness Hierarchy (2), whose central tenet is that the form of referring expressions is dependent on the assumed cognitive status of the referent (Gundel, 1996, 1998; Gundel et al., 1993). The theory is based on the notion of Givenness (Chafe, 1976; Givón, 1983), which is connected with memory and consciousness. Given information is what is more salient and recoverable in the memory structure.

In this theory, the cognitive status is broken down into six ordered categories from most restricted (in focus) to least restricted (type identifiable), which are relevant to different forms of referring expressions. Also, these statuses are not mutually exclusive: the statuses are implicationaly related, such that each status entails all lower statuses. The prediction that follows from the implicational nature of the theory is that a given form may be used not only for referents which satisfy the minimal required status, but also for coding more restrictive statuses. However, the hierarchy interacts with Grice's (1975)

maxim of quantity, such that the highest form that obtains for the referent is more appropriate.

2. Givenness Hierarchy (Gundel et al., 1993, p. 275)



The *in focus* status is when the referent is at the current center of attention. The theory predicts that this status is necessary for felicitous reference by pronouns. Gundel et al., however, do not provide clear predictions about which entities are in focus. They just note that this status is relevant to the local discourse topics, and what will be brought into focus ultimately depends on pragmatic factors, although syntactic and prosodic structures play an important role as well. Because Givenness Hierarchy does not clearly specify how to differentiate different statuses, clear predictions regarding felicitous use of different referring expressions cannot be formulated in this theory.

Centering Theory

Another approach which has developed out of computational linguistics is Centering Theory (Brennan, Friedman, & Pollard, 1987; Gordon et al., 1993; Groz, Joshi, & Weinstein, 1995; Walker et al., 1998). Centering models how the center of attention of discourse conversants relates to the form of referring expressions (Walker et al., 1998). It proposes that an utterance (U_i) evokes a set of forward-looking centers (C_f), or a set representing its discourse entities, which are ranked according to discourse salience. Centering predicts that discourse entities realized in the subject position are more highly ranked than entities in the object position, which in turn are ranked more highly than entities in subordinate clauses or as other grammatical functions. There are other factors

that have been argued to determine discourse salience, including surface position (Brennan, Friedman, & Pollard, 1987) and realization as a pronoun (Walker et al., 1998).

The highest-ranked member of the set (Cf) then is predicted to serve as the backward-looking center (Cb) of the following utterance (U_{i+1}). In other words, Cb is a special member of the Cf, which corresponds to the discourse entity that the U_i most centrally concerns, similar to ‘topic.’ Centering stipulates that the Cb is preferentially realized as a pronoun, which fits the intuition that pronouns are a linguistic device for indicating discourse continuity and coherence. On the other hand, because a name can specify its referent by itself, it is a less optimal device to signal the current utterance’s coherence with the preceding utterance.

Another rule of centering concerns the transition relations regarding the entities that are centered in a discourse segment. When $Cb(U_{i+1})$ is the same as $Cb(U_i)$ and is the most highly ranked element of $Cf(U_{i+1})$, the relation is called CONTINUING. RETAINING is when $Cb(U_{i+1})$ is the same as $Cb(U_i)$ but some other forward-looking center is more highly ranked in $Cf(U_{i+1})$. SHIFTING relation arises when $Cb(U_{i+1})$ is different from $Cb(U_i)$. Centering further predicts that the transition of continuing is more coherent than other relations, and that pronouns are the preferred form for continuing, and nouns are the preferred form for shifting (Walker et al., 1998).

Unlike other approaches, Centering Theory focuses on the relationship between adjacent utterances in *local* discourse and gives more weight to the syntactic position in ranking the set of Cf, with the subject position being more prominent than other syntactic positions. The original proposal, however, was based on English in which word order is fixed and all pronominal forms are overt; later works have tried to capture cross-

linguistic variations taking into account the means (e.g., word order, topicalization) with which different languages indicate various discourse functions (e.g., Hoffman, 1988; Iida, 1998; Walker, Iida, & Cote, 1990, 1994).

The three approaches briefly reviewed in this section share the same goal of explaining the distribution and interpretation of referring expressions in discourse, and in essence, converge on the prediction that a particular referential form is used and processed on the basis of how accessible/given/central the associated entity is. They also maintain that different referential forms serve as processing signals to the addressee who can then restrict the set of possible referents. Ariel's Accessibility Marking Scale and Gundel et al.'s Givenness Hierarchy are more general, covering a broader range of cognitive statuses and referential forms, whereas Centering Theory provides more specific predictions on how an entity acquires the status of high saliency in the local discourse structure, and how this affects the use and interpretation of pronominals (or Ariel's "high accessibility markers").

As will be reviewed in the next section, although many important empirical studies have come out of these theories to determine what makes an entity more accessible or salient, the findings do not yet provide a complete picture. The issue becomes more debatable when the theories are applied cross-linguistically. As will be discussed, cross-linguistic research has suggested that no uniform standard can be applied to understand the way the prominence of an antecedent is determined in different languages (e.g., Alonso-Ovalle, Fernández-Solera, Frazier, & Clifton, 2002 for Spanish; Carminati, 2002 for Italian; Järviski, van Gompel, Hyöna, & Bertram, 2005 for Finnish; Hoffman, 1998 for Turkish; Iida, 1998; Walker, Iida, & Cote, 1990; 1994 for Japanese).

Any theory of prominence should include language-specific considerations, which in turn will help shed insight into the search for cross-linguistic universals.

Determinants of Accessibility

Entities in a discourse model differ in how accessible they are, and various factors have been argued to contribute to prominence, including syntactic features such as grammatical role and surface features such as order of mention (Crawley & Stevenson, 1990; Crawley, Stevenson, & Kleinman, 1990; Gernsbacher & Hargreaves, 1988; Gordon et al., 1993). Semantic or pragmatic factors also play a role including animacy, thematic roles, and topicality such that animate nouns, agents, and discourse topics are more accessible than inanimate nouns, patients, and non-topics, respectively (Christianson, 2002; Comrie, 1989; Nariyama, 2003; Rose, 2007). Also relevant is the “implicit causality” feature in certain verbs that may impute the cause of an event to either to the subject or the non-subject of the clause, and the argument that is understood to be responsible then becomes more accessible (Garnham, Oakhill, Cruttenden, 1992; Garvey, Caramazza, & Yates, 1975; McKoon, Green, Ratcliff, 1993). This review will primarily focus on the following factors: grammatical role and order of mention. It should be noted that these factors are heuristics that come into play only when reference resolution cannot be restricted by grammatical constraints such as gender/number morphology and the Binding Principles (Badecker & Straub, 2002; Nicol & Swiney, 1989, 2002).

Grammatical Role

It has been well-attested that the relative accessibility of different entities in a sentence is determined in part by their grammatical relations, with subjects occupying

more privileged status than other grammatical roles (Keenan & Comrie, 1977). Empirical evidence comes from studies that examined accessibility through its effects on the way pronouns are produced and comprehended, under the assumption that the more accessible an entity, the more likely produced and easily comprehended should be a pronoun being used to refer to that entity.

Hobbs' (1976) analysis of naturally occurring text revealed that 90% of the pronouns referred to previous subjects. In narrative production studies, pronouns are found to more frequently refer to something that was mentioned in subject position than things mentioned in non-subject position (Arnold, 1998; Arnold & Griffin, 2007). In a sentence comprehension study, Crawley and Stevenson (1990) asked participants to complete continuations for sentences like "Shaun led Ben along the path and he ...". Continuations were coded in terms of which referent in the preceding sentence the participants chose as the referent of the pronoun. The results showed that the pronoun was interpreted as referring back to the subject significantly more often than to the object. Even when an ambiguous pronoun was not provided in the sentence completion prompt, participants mentioned the subject more frequently than the object. These findings suggest that writers/speakers tend to continue preceding clause's subject with a subject pronoun in the subsequent mention.

The subject assignment strategy was supported in reading-time studies as well (Frederiksen, 1981; Gordon et al., 1993; Gordon & Chan, 1995; Hudson-D'Zmura & Tanenhaus, 1998; Mathews & Chodorow, 1988). Mathews and Chodorow (1988), for example, examined processing of the pronoun in sentences like (3).

3. a. After the bartender served the patron, *he* got a big tip.
 b. After the bartender served the patron, *he* left a big tip.

They found that participants read the clause with the pronoun faster when the antecedent of the pronoun was occurred in subject position than when it occurred in the object position. Similarly, Frederiksen (1981) and Gordon et al. (1993) found that subject pronouns referring to a noun phrase in the subject position in the previous sentence were interpreted more rapidly than subject pronouns referring to a noun phrase in the object position. Hudson-D’Zmura and Tanenhaus (1998) found that sentences with ambiguous pronouns were read more quickly and judged to be more coherent when the antecedent of the pronoun turned out to be a subject than an object. In addition, Gordon et al. (1993) found what is called a “repeated name penalty,” i.e., a cost associated with using the repeated name coreferentially for the grammatical subject of a sentence in a locally coherent discourse.² The same penalty was observed for an entity that had been realized as a non-initial subject but there was no such penalty for an entity that had been the sentence-initial non-subject. Gordon and Chan (1995) further showed that this repeated-name penalty did not depend on the thematic role of a discourse entity in that the subject of a passive sentence behaved in the same way as the subject of an active sentence. This suggests that status as grammatical subject in a sentence plays an important role in contributing to coherence by pronominal reference in local discourse segments. Taken

² Repeated name penalty as indicated by increased reading times was replicated as an increase in N400 in a series of ERP studies (Camblin, Ledoux, Boudewyn, Gordon, & Swaab, 2007; Ledoux, Gordon, Camblin, & Swaab, 2007; Swabb, Camblin, & Gordon, 2004). Their results show that the amplitude of N400 increases when a repeated name was used coreferentially with a prominent antecedent as compared to when it was used with a non-prominent antecedent. (Prominence was manipulated by varying whether the antecedent formed a single noun phrase or was embedded in a conjunctive noun phrase.) Based on the previous findings that the N400 effect reflects difficulties in lexical integration (e.g., Van Berkum, Hagoort & Brown, 1999; Van Petten & Kutas, 1991), the authors argue that this larger N400 amplitude in the prominent condition reflects difficulty of integrating a name, which tends to have disjoint reference, into a coherent discourse representation.

together, these results indicate that subject position contributes to the prominence of a discourse entity independently of surface position or semantic role.³

A subject bias in the comprehension of pronouns was shown even in 3-year-olds. Through both accuracy in an elicited imitation task and behaviors in a looking-preference task, Song and Fisher (2005) showed that young children treated subjects (or first-mentioned characters) as more accessible than others in the computation of pronominal reference. Megherbi & Ehrlich (2009) replicated Gordon et al.'s (1993) repeated name penalty for a subject entity in 7-year-old children. These findings suggest a robust effect of grammatical role in coreference processing, and continuity in the basic architecture of the language comprehension system across development.

The subject assignment strategy has been found in the processing of null subject pronouns in *pro*-drop languages like Italian and Spanish as well (Alonso-Ovalle et al., 2002; Carminati, 2002). Carminati's (2002) study involving intra-sentential anaphora in Italian showed that a null pronoun prefers a subject antecedent in the Spec IP position. The same pattern persisted even with non-canonical subjects (e.g., dative subject) but not with post-verbal subjects. Based on these findings, Carminati suggests that the processor consults the syntactic representation when resolving anaphora intra-sententially.

³ Most studies have assumed that heuristic strategies like the subject assignment strategy are adopted only when there is no other clear cue to pronoun assignment (e.g., gender/number agreement). For example, Hudson-D'zmura and Tanenhaus (1998) showed that when gender-disambiguated pronouns were used, there was no difference between pronouns which referred to the subject and pronouns which referred to the object in reading times (Experiment 2). There is empirical evidence, however, suggesting that the subject assignment strategy is robust enough to be shown even in the presence of the gender cue. For example, in Tang and van Gompel's (2008) eye-tracking study, gender-unambiguous pronouns that referred to an object antecedent tended to be skipped less frequently than gender-ambiguous pronouns, suggesting that disengagement from a prominent antecedent (subject) is difficult.

Interestingly, “overt” pronouns were shown to have a distinct bias for an antecedent, or a bias towards an antecedent in a syntactic position lower in the phrase structure, suggesting that there is a division of labor between null and overt pronouns. Alonso-Ovalle et al. (2002) replicated Carminati’s findings with Spanish inter-sentential anaphors: null pronouns were more likely to be linked to the subject than overt pronouns. These studies suggest that pronouns and overt pronouns signal different degrees of accessibility of their referent, with accessibility influenced by the syntactic factor. In addition, these findings suggest that the contexts where overt pronouns are called for in English do not always guarantee felicitous use of null pronouns in *pro*-drop languages, and that the functions of referential terms are affected by the available means of coreference in a given language.

Whether the subject preference has a purely structural basis, however, is debatable. Carminati’s (2002) proposal is based primarily on intra-sentential contexts where hierarchical relations between phrases in the sentence are maintained. The subject assignment strategy, however, is not limited to intra-sentential contexts (e.g., Alonso-Ovalle et al., 2002; Gordon et al., 1993). For both intra- and inter sentential cases, syntactic subjects tend to be mentioned earlier in a sentence; tend to be discourse topics; and tend to be thematic agents. This brings up the question of whether the special status of subjects should remain intact when these potentially confounding factors are teased apart.

Word Order

In most of the research reviewed above, subject role could be confounded with order of mention. Previous studies have shown that the first-mentioned entity in a

sentence has a privileged status over other potential antecedents (Gernsbacher, 1990; Gernsbacher & Hargreaves, 1988; Gernsbacher, Hargreaves, & Beeman, 1989).

Gernsbacher and Hargreaves (1988) used a probe-word recognition task to examine the activation level of various referents. The stimulus sentences involved two characters, and after reading each sentence, participants read a probe word and verified whether it occurred in the sentence. The verification latencies revealed that probe recognition was faster when the probe word was the first-mentioned NP. The same advantage was found for the first-mentioned NP in a passive sentence, suggesting that the advantage was not due to their being the semantic agent of the sentence. Moreover, this advantage was still observed when the first-mentioned NP shared subjecthood with the second-mentioned participants (e.g., “Tina and Lisa argued during the meeting.”) and even when the first-mentioned NP was not a grammatical subject (e.g., “Because of Lisa, Tina was evicted from the apartment.”). According to Gernsbacher and Hargreaves (1988), the first-mentioned entity lays a foundation for the representation of the information in the upcoming sentence by coding importance and functioning to attract attention. Initial mention is also argued to code givenness and create a context for subsequent comprehension, and hence more accessible (Gernsbacher & Hargreaves, 1988).

These studies, however, have been criticized as not tapping into the processes that are actually involved in referential processing. Rather, the probe-word task might reflect the use of strategies specific to probe recognition (Gordon, Hendrick, & Foster, 2000). Gordon et al. (2000) showed that response times to probe words increase with the size of the set of candidate probes, suggesting that responses in the task can be based on probe-

list memory, or a task-specific strategy to keep track of those words that the participant believes are likely to be probed. Nicol and Swinney (2002) similarly argued that the probe-recognition task could just reflect left-to-right playback of the sentence. These authors warn that it is difficult to make inferences about language comprehension based on probe-recognition tasks without controls ruling out the use of such strategies.

Supporting evidence for the first-mention advantage in actual anaphor processing comes from Gordon et al. (1993, Experiment 5), which found a repeated-name penalty for a referent that had been realized as a surface-initial non-subject in the previous sentence in sentences sets like (4).

4.
 - a. *Susan* gave *Fred* a pet hamster.
 - b. In *his* opinion, *she* shouldn't have done that.
 - c. *She* / *Susan* just assumed that anyone would love a hamster.
 - c'. *He* / *Fred* doesn't have anywhere to put a hamster cage.

The magnitude of repeated-name penalty in (4c') did not differ from that of an entity which had been the non-initial subject of the previous sentence (4c), suggesting that both initial mention and grammatical role contribute to promote the prominence of an entity in the discourse. Caution is needed, however, in arguing for the role of surface position as an important determinant of prominence, because, it is not clear whether the repeated-name penalty in sentences like (4c') has been due to the surface position of the non-subject or the pronominalization in the previous sentence (4b). As reviewed above, pronouns serve as a processing signal to indicate high prominence of their intended referent (Ariel, 1988, 1990, 1996; Gordon, et al., 1993; Gundel et al., 1993).

Except for a few cases just reviewed, the subject-preference account and the first-mention account make identical predictions in languages like English that have relatively rigid subject-object word order. The question of whether the special

prominence of subjects should still hold when the subject yields its sentence-initial position to other roles can be more easily tested in languages with relatively free word order. Considering that word order variation in many languages is motivated by information structural reasons such that old information/topic precedes new information/focus (Lambrecht, 1994), the question can be rephrased as how referent prominence is determined in cases where the subject loses its default topic status and appears in a sentence non-initial position.

Järvikivi et al. (2005) conducted a visual-world eye movement study of Finnish pronoun resolution (*hän* 's/he'). Participants listened to sentences in either canonical, SVO or scrambled, OVS order followed by a sentence containing an ambiguous pronoun that referred to either the subject or the object. Participants' eye movements were recorded while they looked at pictures of the two possible antecedents of the pronoun. The results showed clear effects of both grammatical role and order of mention. Upon hearing the pronoun, participants fixated more often on pictures of the subject in the preceding sentence than on pictures of the object, and more often on pictures of the first-mentioned character than the second-mentioned character. Despite the main effect of order of mention across the SVO and OSV orders, no preference for the object over the subject was found when only the OVS sentences were considered, suggesting that Gernsbacher's first-mention account alone does not satisfactorily account for pronoun resolution.

Based on a sentence continuation study in Finnish, Kaiser (2005) reports different findings. The stimuli consisted of SVO and OVS sentences followed by a sentence beginning with the pronoun *hän* 's/he.' The results revealed a clear preference

for subjects but not for first-mentioned entities. Kaiser and Trueswell's (in press, Experiment 3) eye-tracking study also found the pronoun's (*hän*) early sensitivity to grammatical role. In a similar vein, Hoffman's (1998) Turkish data based on a corpus study reveal the subject bias following both canonical SOV and non-canonical (OSV, SVO, OVS) antecedent sentences. The general conclusion Hoffman provides is that the prominence of a referent correlates with its grammatical role, and is not much affected by word order.

Thus, there seems to be a consensus that the subject in the antecedent sentence plays a crucial role in the determination of prominence, but the role of word order is less well understood. Both Kaiser and Trueswell (in press) and Hoffman (1998) point out that word order variation in Finnish and Turkish, respectively, is discourse-driven; non-subject NPs may appear sentence initially when they are discourse-old. Thus, it is rather surprising that scrambling, which is not just a matter of surface feature but is understood to signal 'givenness/topichood,' did not result in any processing advantage of associated reduced referential terms. Hoffman provides a view that reference resolution and information structure are separated from each other. She further argues that the sentence topic "instructs the hearer to go to a certain file card in order to update it," whereas the referential form of NPs "indicates how accessible file cards are" (p. 270).

Referential Ambiguity

One issue that was not clearly addressed in the theories of reference is how the ambiguity of pronominal reference interacts with the accessibility of the intended referent. For example, are morphologically unambiguous pronouns and ambiguous

pronouns subject to the same accessibility scale despite their difference in terms of rigidity, or the ability to uniquely refer (Ariel, 1990)? Referential ambiguity arises when a unique referent for an anaphor cannot be selected, and temporary referential ambiguity is especially common with pronouns as they do not carry rich informational content and in many cases depend their interpretation on the following words.

Several studies have suggested that pronouns are harder to process when there are two (or more) possible antecedents than when there is only one antecedent or when clear cues such as gender or number disambiguate the pronoun (Garnham et al., 1992; Mathews & Chodorow, 1988; MacDonald & MacWhinney, 1990; Rigalleau et al., 2004). Using probe verification, MacDonald and MacWhinney (1990) reported that ambiguous pronouns showed substantially delayed recognition of antecedent probe words. In self-paced reading studies, readers are known to slow down at or after referentially ambiguous words (Stewart, Holler, & Kidd, 2007). In terms of accuracy, unambiguous pronouns tend to be interpreted more accurately than (temporarily) ambiguous pronouns (Foraker & McElree, 2007).

Ambiguous pronouns may show processing disadvantage as compared with unambiguous pronouns, but are they still preferred over less accessible markers when used to refer to accessible entities (Walker et al., 1998)? There are only a handful of studies that addressed this question. In a production study, Arnold, Eisenband, Brown-Schmidt, and Trueswell (2000) investigated felicitous pronoun use in a written questionnaire. Participants read sentences such as “The bride/groom embraced the maid of honor after the wedding” and added a natural continuation. Their results are

reproduced in (5). The results suggest that ambiguous as well as unambiguous pronouns may serve as a natural continuation for a prominent entity.

5. Percentage pronoun use (Arnold et al., 2000, p. B16)

	<i>1st character (Subject)</i>	<i>2nd character (Object)</i>
Gender-different (unambiguous)	95	76
Gender-same (ambiguous)	95	37

In a self-paced reading study, Gordon and Searce (1995) argued that the penalty of using names to refer to an entity in the subject position could occur even with syntactically ambiguous pronouns. Hudson-D’Zmura and Tanenhaus (1998) replicated these results with reading time and coherence-judgment measures. Firm conclusions cannot be drawn, however, because these studies suffer from some methodological problems, which will be discussed in more detail in Chapter 3. Tang and van Gompel (2008) tested whether repeated names are easier to process when the gender of the potential antecedents was the same than different, but found no such evidence. However, they compared reading times of repeated names under the same vs. different conditions without varying the anaphor type itself (i.e., name vs. pronoun), and hence it is impossible to conclude whether pronouns would be as easily processed under these conditions.

To the extent that repeated name penalties can be generalized to ambiguous pronouns, the same penalty should occur with null pronouns in *pro*-drop languages like Korean, which are potentially ambiguous lacking morphological cues altogether.

Two-Stage Models of Anaphor Processing

Some accounts of anaphor processing have proposed that pronouns are processed at different levels of specification (Garrod, 1994; Garrod & Sanford, 1994; Garrod & Terras, 2000; Greene, McKoon, & Ratcliff, 1992; Rigalleau, Caplan, Baudiffier, 2004). Garrod (1994) distinguishes *bonding* and *resolution* in anaphor resolution: the former is viewed as “a low-level matching process that highlights the anaphora-antecedent link but without necessarily committing the processor to any particular semantic interpretation at that input” and the latter refers to “the process of incorporating a particular semantic interpretation of the anaphora ... into the semantic representation being constructed for the sentence” (p. 349). According to this distinction, committing to a full referential interpretation of a pronoun does not always occur (Garrod, 1994; Garrod & Terras, 2000). In a similar vein, Greene et al. (1992) distinguish *automatic* and *strategic* processes in pronoun resolution. They propose that a pronoun can be automatically understood if its intended referent is sufficiently more highly accessible in the comprehender’s discourse model; if there is no discourse entity that stands out sufficiently well, then no unique referent may be identified, and some kind of strategic or problem-solving process should be invoked. Rigalleau et al. (2004) propose a two-stage model similar to Greene et al.’s account. During the first *co-indexation* stage, automatic matching between the pronoun and the most accessible referential candidate occurs; during the second, *disengagement* stage, the activation of the competing nonreferent is suppressed.⁴

⁴ Rigalleau et al.’s (2004) model was initially proposed to account for how gender information is used, but the model has been extended to include the processing of ambiguous pronouns under different processing demands (e.g., Stewart et al., 2007).

These models have been used to explain how ambiguous and unambiguous pronouns are processed under different processing demands. The morphological cues in unambiguous pronouns can result in early resolution or disengagement (Rigalleau et al., 2004). For ambiguous pronouns, there is evidence showing that multiple antecedents that satisfy the morphological and grammatical filter are rapidly activated (Nicol & Swinney, 1989). Badecker and Straub (2002) suggest that the initial stages are governed not only by structural constraints but also by the saliency/focus status of candidate antecedents. Importantly, since the second stage cannot be completed within ambiguous pronouns, and the first stage can proceed automatically, these models predict that ambiguous pronouns may not result in additional processing cost as compared with unambiguous pronouns when only the pronoun regions are compared.

Some empirical evidence for this prediction comes from Vonk's (1984) eye-tracking study, which found that first pass times were even longer in unambiguous pronouns than in ambiguous pronouns, suggesting that the resolution process does involve processing efforts. Tang and van Gompel (2009) showed that sentences with a gender ambiguous pronoun are processed as fast as sentences with an unambiguous subject-referring pronoun and faster than sentences with an unambiguous object-referring pronoun. During later processing, these studies showed that the ambiguous condition was harder to read than the unambiguous condition.

The strategic nature of the second stage challenges the traditional view that pronominal referents are always automatically and fully identified. Recent empirical studies have suggested that pronouns may sometimes be left delayed or unresolved since parsing does not typically depend on having computed coreference (Greene et al., 1992;

McKoon, Ward, Ratcliff, & Sproat, 1993; Nicol & Swiney, 2002; Rigalleau et al., 2004; Stewart et al., 2007).⁵

For example, studies have shown that the likelihood of successful resolution of an anaphor depends in large part on the extent to which resolution is necessary to create a coherent discourse representation (Klin, Guzmán, Weingartner, & Ralano, 2006; Klin, Weingartner, Guzmán, & Levine, 2004; Levine, Guzmán, & Klin 2000). Greene et al. (1992) argue that the slow presentation of materials and the motivation to uniquely identify the referents allow participants to engage in strategic processes to resolve the pronoun references. In their probe-recognition study, when participants were presented with text at a very fast rate (250 ms per word), and comprehension questions did not directly ask specifically for information about the intended referents of pronouns, processing of the pronoun did not facilitate responses to the referent probe test word relative to the nonreferent test word.

Stewart et al. (2007) also emphasize the role of probe questions as a determining factor for how strongly the referential link between anaphor and antecedent is formed. In sentences such as “Paul lent Rick the CD before *he* left for the holidays” no preference

⁵ The argument that pronoun resolution may remain incomplete can be understood within the more general idea that language processing is often based on shallow processing, generating a “good enough” representation rather than a detailed representation that is faithful to the input (Christianson, Hollingworth, Halliwell, & Ferreira, 2001; Ferreria, 2003; Sanford, 2002). Recent research has shown that situation-specific knowledge or the plausibility of the ultimate interpretation can intervene the local processing of structure or meaning, and result in interpretations that are not faithful to the input (Christianson et al., 2001; Sanford & Sturt, 2002). Factors such as such as time pressure and resource constraints have been also argued to influence the extent to which the language comprehension system operates in a good-enough way. The same argument can apply to the domain of interpretation of pronouns. Future research is called for to explore how these and other factors affect the degree to which pronouns may be left unresolved or only partially resolved.

for either ‘Paul’ or ‘Rick’ as an antecedent of the pronoun was found when only shallow-processing questions were asked (e.g., yes-no questions unrelated to coreference processing). Significant increase in reading times in the disambiguation region as compared with the unambiguous condition was visible only when the comprehension questions probed the information content of the referent of the pronoun. They suggested that whether or not resolution of an ambiguous pronoun is delayed is determined by depth of processing; if a comprehension question does not require resolution to take place, the pronoun may go unresolved. These studies provide a methodological implication that the depth of processing the reader is engaged in is affected by the type of comprehension questions.

Processing of Coreference in L2

The literature on comparative studies on narrative production has shown that the system of reference management differs cross-linguistically (Clancy, 1980; Givón, 1983; Hickmann, 1996, 1999) and that L2 learners often fail to acquire the target system (Gundel & Tarone, 1993; Kang 2004; 2009). Proper use and interpretation of referring expressions requires knowledge on both syntactic and discourse conditions governing their distribution in context (Sorace & Filiaci, 2006). According to the Interface Hypothesis proposed by Sorace and Filiaci (2006), L2 grammatical aspects such as reference that involve an interface between syntax and other domains pose particular learning difficulties, and are prone to L1 transfer effects and residual optionality.⁶

⁶ Sorace (2000, p. 93) defines syntactic optionality as the “coexistence within an individual grammar of two or more variants of a given construction, which make use of

The difficulties associated with the syntax-pragmatics coordination problem in the use of the reference system have been observed among various language development populations including simultaneous bilingual children (Hulk & Müller, 2000; Serratrice, Sorace, & Paoli, 2004), heritage speakers (Montrul, 2004; Tsimpli, Sorace, Heycock, & Filiaci, 2004), and adult L2 learners (Sorace & Filiaci, 2006). These studies paid special attention on the distributional differences between overt and null pronouns in Romance *pro*-drop languages.

Serratrice et al. (2004) analyzed longitudinal data of English-Italian bilingual children acquiring the two languages simultaneously. They found that the bilingual children used overt pronominal subjects in contexts where monolinguals would use a null subject in Italian. They suggested that these children opted for the pragmatically unconstrained option in English in situations requiring sophisticated pragmatic understanding on the use of two syntactic alternatives in Italian.

Montrul's (2004) analyses of narratives produced by advanced and intermediate Spanish heritage speakers of English and monolingual English speakers showed that the grammars of lower proficiency heritage speakers were characterized by convergence with English, resulting in pragmatically divergent use of subjects in Spanish (i.e., extending overt pronouns to the contexts that require a null subject). Montrul concluded that the syntax-pragmatic interface conditions on the use of pronouns are susceptible to manifestation of L1 attrition.

Sorace and Filiaci (2006) compared native Italian speakers and native English speakers who had learned Italian as adults and who had reached a near-native

the same lexical resources; and express the same meaning.” In L2 grammars, residual optionality is regarded as a type of deviance from the target grammar.

proficiency, in a picture-verification task requiring resolution of intra-sentential anaphora in Italian. They specifically tested Carminati's (2002) observation that null pronouns are strongly biased towards an antecedent in the [Spec, IP], whereas overt pronouns prefer an antecedent in a lower syntactic position in Italian. The results showed that near-natives had a higher tendency than Italian native speakers to choose the subject in the [Spec, IP] as a possible antecedent of overt subject pronouns. Sorace and Filiaci argued that this result could be interpreted as stemming from indeterminacy at the syntax-pragmatics interface and a possible L1 influence mapping the overt pronoun to the [-Topic Shift] feature. In contrast, no processing differences between the two groups were found for the interpretation of null subjects.

Difficulties are not limited to cases involving L2 learners from a non-null subject language background (e.g., English) learning a null subject language (e.g., Italian and Spanish). It generally holds true that learners from a null subject background learning a non-null subject language soon realize that subjects are obligatory in languages like English (White, 1985). For this reason, evidence for non-convergence has not been clearly shown when the focus was on the use of overt vs. null subjects in a non-null subject L2.⁷ However, a recent study by Roberts, Gullberg, and Indefrey (2008) that tapped into subtle interpretation preferences of overt pronouns in Dutch suggests that overt pronouns maybe also subject to optionality. They compared Turkish L2 learners of

⁷ There has been considerable research on the acquisition of pronouns in an L2 that investigated the so-called "*pro*-drop parameter" (e.g., Gass, 1996; Hilles, 1986; White, 1985; Yuan, 1997) and a cluster of properties associated with it (Chomsky, 1981). The findings from work on this vein are that not all properties of what has been traditionally subsumed under the *pro*-drop parameter may not be uniformly learned at once, but that language learners can soon reach a level at which they properly understand and utilize the target linguistic forms (null vs. overt pronouns) in the L2.

Dutch and Dutch native speakers in the resolution of subject pronouns in Dutch. The study specifically addressed the question of whether Turkish L2 learners treat overt subjects in Dutch like null pronouns or overt pronouns in their L1, in which the overt pronouns signal topic shift. L2 learners of Dutch from a non-null subject language (German) were also included in the study to tease L1 effects apart from potential general L2 processing effects. The results showed that in the processing of the Dutch version of sentences such as (6), the Turkish speakers interpreted ‘he’ as coreferential with ‘Hans’ 45% of the times unlike the Dutch monolinguals who chose ‘Peter’ 100% times. The German speakers patterned with the Dutch monolingual speakers in the off-line measures, but interestingly, they patterned with the Turkish speakers in the on-line measures.

6. *Peter and Hans are in the office. While Peter is working, he is eating a sandwich.*

Kang (2004, 2009) is one of the few studies that investigated the acquisition of a non-null subject language (English) by speakers of an East Asian *pro*-drop language (Korean). She examined oral and written narratives produced by Korean L2 learners in L1 Korean and L2 English, and by native English speakers in L1 English to determine the extent to which Korean learners of English are able to utilize English referential system and whether they rely on L1 Korean linguistic strategies in English narratives. The proportions of different referential choices compared for each character in the story showed that there was no sign of direct language transfer of null pronouns in L1 Korean to L2 English. Interestingly, however, the Korean speakers did not use pronouns as frequently as the native English speakers. Instead, they had a tendency to rely on explicit reference, which was also true in their L1 narratives. Kang discusses the results in terms

of the L1 transfer effect, but as she correctly recognizes, there is a possibility that L2 learners might have a general tendency to be overtly explicit to avoid any potential ambiguity that might follow from incorrect use of pronominals. In either case, the study suggests that acquiring the discourse norms of referential forms in the target language is a challenging task for language learners.

A consistent emphasis of these studies is that there is L1 influence on the learning of L2 interface conditions when the two systems are different. Considering that interpretation of a pronoun in discourse in any language requires integrating the necessary syntactic and discourse conditions (Roberts et al., 2008), however, cross-linguistic influence might not be the underlying cause for the instability at interfaces. By definition, coordinating two different sources of information might itself pose difficulty for L2 learners, as L2 processing is characterized by higher cognitive demands (Dussias, 2003) and shallower syntactic details (Clahsen & Felser, 2006).

To be able to fully address the role of cross-linguistic influence, it seems important to compare different L1 groups acquiring the same L2 (Sorace, 2008). Emerging evidence has shown that optionality in the domain of subject pronouns is attested not only in bilingual speakers of two languages that are typologically different (e.g., Spanish-English) but also in bilinguals of two similar languages (e.g., Greek-Spanish). For example, Margaza and Bel (2006) showed that overt pronouns were also overextended by L1 Greek speakers of L2 Spanish, suggesting that the original finding involving a non-null subject L1 and a null-subject L2 might not be due to cross-linguistic influence as originally claimed (Montrul, 2004; Serratrice et al., 2004; Sorace & Filiaci, 2006). As Sorace (2008) suggests, L2 learners may use overt pronouns as default forms

in their interlanguage regardless of L1 backgrounds in order to relieve processing overload and avoid ambiguity with null pronouns. The view that observed difficulties at the interface is due to L1 transfer seems to fall short of explaining these findings. In a similar vein, the results of Kang's (2004, 2009) study showing L2 learners' overuse of explicit reference instead of pronouns might be interpreted as suggesting an attempt to avoid ambiguity and to reduce the load of maintaining in working memory the information of what the antecedent of a pronoun is. In light of these recent findings that suggest computational limitations of processing in the L2 (e.g., Clahsen & Felser, 2006; Hopp, 2007; Sorace, 2008), it seems debatable to what extent the difficulties at the interface (more specifically, difficulties with more reduced referring expressions) are actually due to L1 transfer.

CHAPTER 3

COREFERENCE PROCESSING IN ENGLISH

The accessibility of an entity is determined in part by the syntactic means by which it is introduced; as subjects are more accessible than objects, they are good candidate antecedents for pronominal reference (Keenan & Comrie, 1977; Walker et al., 1998). Experiments 1 and 2 aim to replicate the previous finding that there is a preference to interpret an ambiguous pronoun as coreferential with the grammatical subject instead of the grammatical object in the preceding utterance, using a self-paced reading task (Arnold et al., 2000; Frederiksen, 1981; Mathews & Chodorow, 1988). The second goal is to test whether the finding that there is a penalty associated with using a repeated name as compared with using a pronoun to refer to the most accessible entity in the local discourse (Gordon et al., 1993; Gordon & Chan, 1995) generalizes to contexts where the referent of a pronoun is grammatically ambiguous.

Experiment 1

Experiment 1 was designed to replicate the previous findings that an ambiguous pronoun is preferentially interpreted to refer to the subject of the previous sentence and that the most accessible entity in the previous sentence, which is often the subject, is preferentially realized as a pronoun than a repeated name, using passages like the following:

1.
 - a. The computer seemed to have caught a virus.
 - b. Ben called Matt for help.
 - c. *He/Ben* asked Matt to take a look at the computer.
 - c'. *He/Matt* asked Ben what the problem was.
 - d. A lot of important data seemed to be missing.

The critical sentence was the third sentence in the discourse (1c/1c') which varied in terms of whether the grammatical subject in this sentence referred to the subject or the object in the preceding sentence and whether it was realized as a pronoun or a repeated name.

It has been demonstrated that subject pronouns referring to a noun phrase in the subject position in the previous sentence are interpreted more rapidly than subject pronouns referring to a noun phrase in the object position (Frederiksen, 1981; Mathews & Chodorow, 1988). The strategy of assigning a subject antecedent to an ambiguous pronoun predicts that the pronoun at the beginning of (1c) and (1c') will preferentially be interpreted as coreferential with the subject entity 'Ben' in (1b). Therefore, the pronoun condition of (1c) will be easier to process than the pronoun condition of (1c'), which requires the revision of the initial interpretation of linking the pronoun to the subject of the previous sentence to reassign it to the object entity.

The subject assignment strategy can also be understood in terms of a more general tendency to continue talking about the same topic rather than switching topics from one sentence to another. Using the terminology from centering theory, the contrast between (1c) and (1c') illustrates CONTINUE vs. SHIFT. In (1c), it "continues" the subject of the previous sentence, whereas in (1c'), it "shifts" the subject of the previous sentence (Grosz et al. 1995; Walker et al., 1998). Centering predicts that the transition of continuing is more coherent than shifting, and pronouns are the preferred form for continuing. Upon this prediction, regardless of the type of the anaphor (1c) will be easier than (1c').

Previous studies also have shown that there is a penalty associated with using a name repeatedly as compared to using a pronoun in the grammatical subject of a sentence

for a previously mentioned entity in a local discourse (Gordon & Chan, 1995; Gordon et al., 1993; Gordon & Searce, 1995; Swaab et al., 2004). This is interpreted within centering theory as indicating disrupted coherence because the use of reduced referring expressions such as pronouns indicates continuity in the discourse whereas less reduced referring expressions such as names signal shifting. This characterization is reminiscent of the well-known binding principle C which stipulates that referential expressions (e.g. "the dog" or "John") independently refer or pick out entities in the world unlike pronouns and reflexives (Chomsky, 1981). Although principle C holds in the domain of roughly a clause, the difficulty of establishing coreference with a repeated name across sentences reflects the same tendency of a name as an independent referring expression.

The penalty has been claimed to be observable only for highly accessible entities such as grammatical subjects; using repeated names for previously mentioned grammatical objects does not result in the same magnitude of reading time costs (Gordon et al., 1993; Gordon & Searce, 1995). Originally, this penalty was shown using unambiguous pronouns based on the gender cue (Gordon et al., 1993; Gordon & Chan, 1995). Later studies have suggested that the repeated name penalty generalizes to syntactically ambiguous pronouns as well (Gordon & Searce, 1995; Hudson-D'zmura & Tanenhaus, 1998). If the penalty occurs with syntactically ambiguous pronouns as argued in the previous studies, longer reading times are expected in the name condition than in the pronoun condition in the critical sentence (1c/1c').

Experiment 1 shares the same goal with the previous studies of determining whether the penalty occurs with subject-referring pronouns. However, review of previous studies necessitates some important modifications. The first change concerns the type of

materials used. In Gordon et al.'s (1993) original study reporting a repeated-name penalty for the subject antecedent, sentences like the following were used:

2.
 - a. George jumped out from behind a tree and frightened Debbie.
 - b. He was surprised at her hysterical reaction.
 - c. *He/George* never thinks about how others might feel.
 - c'. *She/Debbie* screamed loudly and ran away.
 - d. Practical jokes are not always fun for everyone.

A substantial repeated-name penalty was observed in (2c) where the most accessible entity in (2a) (i.e., the grammatical subject) was realized as a name but there was no cost in (2c') where the nonprominent entity was realized as a name. However, it is worth noting that the entities in the antecedent sentence are realized as pronouns in (2b) before the critical sentence (2c/2c') is presented. This makes it unclear whether the extra reading times in the name condition follow solely from the name to name transition, as the authors claim. Instead, the increased reading times in the name condition might have come from potential costs due to switching pronominal reference in (2b) back to a name in (2c). The same problem is found in Gordon and Searce's (1995) study that argued for the presence of the repeated name penalty even for ambiguous pronouns. To rule out any effect of pronominalization on the processing of anaphors in the critical sentence, in the present study, the critical sentence contrasting the use of pronoun and name directly followed the sentence introducing discourse entities without any intervening pronominals.

Secondly, previous studies reporting the repeated name penalty considered the mean reading times for the frames in question as their main dependent variable. However, pronouns are usually shorter than names and this difference in length might have contributed to the observed reading time differences, however small this influence might

be. The present study converted all raw reading times to residual reading times to adjust region length differences (Ferreira & Clifton, 1986).

To summarize, the present study was designed to address the following questions. First, is the subject assignment strategy the initial default for an ambiguous pronoun? Second, is there a preference for referring to an entity in a local discourse by using a pronoun relative to using a name when the pronoun does not syntactically disambiguate its referent, and if so, is the preference observable only for an entity in subject position?

Method

Participants

Forty-four University of Illinois students (24 females) participated in the experiment for partial course credit. All were native speakers of English. Eight of the forty-four participants were excluded from the analyses because of a high error rate (greater than 20%) on comprehension questions asked after about 40% of the items, leaving thirty-six participants. These participants' mean accuracy was 86.3%.

Materials

Twenty-four, four-sentence passages were constructed as illustrated in (1) above. The first sentence (1a) of each passage provided the discourse context for the passage. The second sentence (1b) introduced two characters by name with one of the characters being the subject and the other character being the object. The names were stereotypically of the same gender and names of each gender were used equally often across the stimulus passages. The third sentence (1c/1c') was the critical sentence and contained two manipulations with two levels resulting in four alternative versions. One manipulation varied whether the grammatical subject of this sentence referred to the grammatical

subject or the grammatical object of the previous sentence. The second manipulation concerned whether the grammatical subject of this sentence was realized as a pronoun or a repeated name. The last sentence (1d) was the wrap-up sentence of the passage and did not mention either of the two characters. In addition to these passages, there were 110 filler passages. These fillers consisted of four- or five-clause discourses and were of the same general format (i.e., discourse participants engaged in some activity); noun phrases and job titles as well as names were used to refer to discourse characters. Twenty-four of the filler passages served as the stimuli for Experiment 2. Comprehension questions that required understanding of the various parts of the passages were also constructed for fifty of the filler items.

Four 134-item lists were created, each containing one version of each of the 24 experimental items and 110 filler items. Four additional practice items were constructed and were presented at the beginning of each list. Each list contained one version of each experimental passage and equal number of items in each condition. Experimental and filler items were pseudorandomly presented such that no two experimental trials appeared consecutively. The experimental passages are listed in APPENDIX A.

Procedure

The experiment was run using the E-prime software. Participants were seated in front a computer screen with a button box placed in front of them. The buttons were labeled with '1', '→', and '2'. The materials were presented one clause at a time and participants controlled the presentation rate by pressing the arrow button on the button box. The start of a new trial set was indicated by an arrow symbol in the center of the screen, and a new sentence was presented when participants pressed the arrow button.

Comprehension questions appeared about 40% of the trials (all fillers) and had two choices; participants pressed either '1' or '2' to answer the questions. Participants were instructed to read each clause for good comprehension at their normal reading pace. The entire session lasted approximately 30 minutes.

Results

Residual Reading Times at the Critical Sentence

All raw reading times were converted to residual reading times across filler and experimental items after removing outliers based on the following criteria. First, reading times shorter than 500 ms were removed because it was unlikely that a clause would be read in so short a time, resulting in a loss of less than 0.1% of the data.⁸ Then reading times longer than 5000 ms were replaced with the cut-off value. This affected 0.9% of the data. Also trimmed were the reading times which had shorter than 500 ms reading times at the sentences before this critical region (i.e., either the sentence providing the context for the rest of the discourse or the sentence introducing discourse participants). This process resulted in the loss of 0.9% of the data. After removing outliers, the raw reading times were converted to residual reading times by first calculating the linear regression equation that predicts reading times for regions of differing lengths and then subtracting the predicted reading time from the obtained reading time (Ferreira & Clifton, 1986). Positive reading times represent slower reading times than expected and negative reading times indicate faster reading times than expected for a region of given length.

⁸ I report the percentage of affected data in the experimental trials only throughout the dissertation although data from filler trials were also considered in the calculation of regression equations and were trimmed based on the same criteria.

The data were analyzed using linear mixed modeling that incorporates both fixed and random effects,⁹ in the statistical environment R (R Development Core Team, 2010). Grammatical role of antecedent (subject or object), type of anaphor (pronoun or name), and their interaction were included as fixed effects.¹⁰ Trial number was also included as a fixed effect. Subject, item, and list were considered as random effects. The models were fitted using a stepwise model selection procedure and likelihood ratio tests were used to determine the right level of complexity of the random effects for the data set (Baayen, 2008; Baayen et al., 2008). Based on the likelihood ratio tests, a model with subject and item as random effects was selected (random intercepts only); the list parameter was not justified in the model comparison and was not included in the reported model. The *p*-values for model parameters were estimated using Markov-Chain Monte Carlo sampling.

The results of the model ($r^2=.22$, $\kappa=4.33$)¹¹ are summarized in Table 1. The model revealed an effect of antecedent, with the object antecedent condition read significantly more slowly than the subject antecedent condition. The interaction between grammatical

⁹ Mixed-effects models have advantages over traditional ANOVAs in several important ways. First of all, they allow consideration of all factors that potentially contribute to the understanding of the structure of the data, such as effects of familiarization and fatigue (Baayen, 2008; Baayen, Davidson, & Bates, 2008). They are also more flexible in dealing with missing data resulting in less loss of statistical power in unbalanced designs (Baayen et al., 2008). Finally, as mixed models can include multiple random effects, random subject and item effects can be modeled in a single step of analysis instead of separate by-subjects and by-items analyses.

¹⁰ Contrast coding was used. The default in R is dummy coding, (e.g., “0” for baseline, “1” for other) which compares all other levels to a baseline level. Contrast coding (e.g., “-1” vs. “1”) is more appropriate for determining whether there is an overall effect of the variable (Jaeger & Kuperman, 2009).

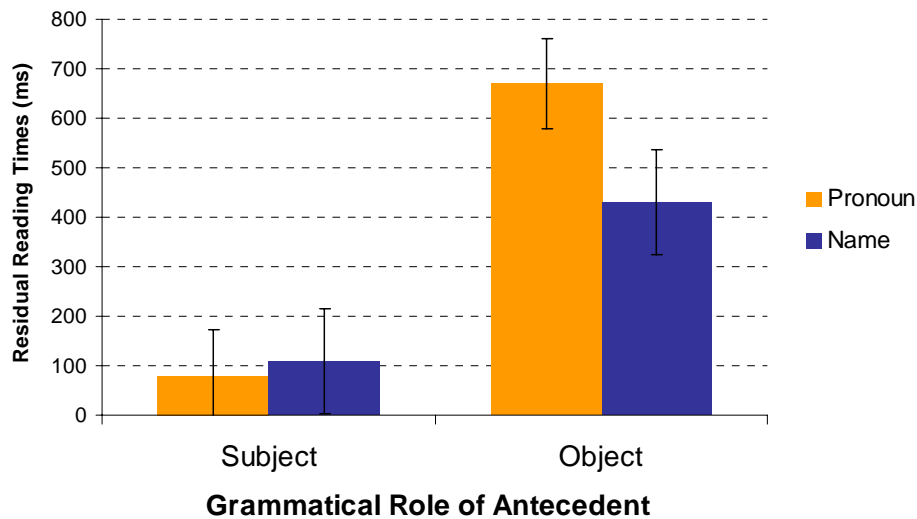
¹¹ The r^2 value is the square of the correlation coefficient between the observed and fitted data values, which gives information about the goodness of fit of a model. Kappa (κ) statistic shows whether the predictors in a model are correlated. Collinearity inflates standard errors of collinear predictors and makes coefficients of collinear predictors hard to interpret. Generally, κ over 10 implies that there is some collinearity present in the model (Jaeger & Kuperman, 2009).

role of antecedent and type of anaphor was also significant such that pronouns were read significantly more slowly than names in the object antecedent condition. These results are represented graphically in Figure 1. The model also revealed an effect of trial indicating that participants sped up as they progressed through the experiment. The reading times before or after the critical sentence did not vary significantly depending on the antecedent or anaphor types.

Table 1

Linear Mixed Model Output for the Residual Reading Times at the Critical Region (Experiment 1)

	Estimate	Std. Error	<i>t</i> value	Pr(> <i>t</i>)
(Intercept)	591.94	75.44	7.85	0.00**
Trial	-3.72	0.74	-5.00	0.00**
Grammatical Role of Antecedent (GR)	217.17	27.14	8.00	0.00**
Type of Anaphor (ANA)	-45.01	27.08	-1.66	0.10
GR × ANA	-74.56	27.12	-2.75	0.01*



(Error bars represent 95% confidence intervals)

Figure 1. Residual reading times at the critical sentence (Experiment 1)

Discussion

The results provide support for the subject assignment strategy in the interpretation of ambiguous pronouns as suggested by shorter reading times in the

sentence where the pronoun turned out to refer to the subject antecedent than in the sentence where the pronoun turned out to refer to the object antecedent. Increased reading times in the object antecedent condition indicate the difficulty associated with fixing the initial interpretation of linking an ambiguous pronoun to the subject antecedent when unfolding information demands reassignment of the pronoun to the object antecedent.

The overall advantage of the subject antecedent condition over the object antecedent condition across both the pronoun and name conditions suggests that there is a general preference to have the same entity in the subject position of two adjacent sentences than to have two different entities in the subject position of the two sentences. This is in line with the prediction from centering approach, according to which discourses that continue centering the same entity are more coherent than those that shift from one center to another (Groz et al., 1995; Walker et al., 1998).

The results did not replicate the previous finding on the repeated name penalty, which predicts shorter reading times for pronouns than names to refer to a prominent referent. In the present study, there was no observable repeated name penalty in the subject antecedent condition but a significant interaction between anaphor type and antecedent type was found. In the object antecedent condition, reading times were longer in the pronoun condition than in the name condition, suggesting that a less prominent entity in a discourse is not preferentially realized as a pronoun. This tendency is believed to be more pronounced when the use of pronoun is formally ambiguous. The lack of repeated name penalty in the subject antecedent condition can be understood as a result of an advantage from names' ability to unambiguously refer. And yet, the results suggest that grammatical subjects are accessible enough to be referred to with a pronoun even

when there are other competing candidate antecedents that match the morphological features of the pronoun. These results can be understood in terms of the interplay of the relative discourse prominence of potential antecedents and the ambiguity of referring expressions.

Experiment 2

Experiment 2 aims to further determine the extent to which the processing of different forms of anaphors is influenced by referential ambiguity and the relative accessibility of referents. Another goal was to explore the locus of ambiguity effects in the two-stage models of anaphor processing, which distinguish the initial stage where a superficial anaphoric link(s) is formed and the stage where the anaphor is fully resolved (Garrod, 1994; Garrod & Sanford, 1994; Greene et al., 1992; Rigalleau et al., 2004).

The results of Experiment 1 showed that name anaphors did not result in additional reading time costs compared with pronouns which were grammatically ambiguous, when they were used to refer to the subject antecedent in the previous sentence. Both unambiguous names and ambiguous pronouns were processed equally fast to refer to the subject referent in the previous sentence, whereas names but not pronouns were preferred to refer to the object antecedent in the previous sentence, suggesting that the processing of coreference is influenced by both prominence and ambiguity considerations.

In Experiment 1, however, pronominal ambiguity was considered only in a narrow sense of whether or not there is more than one gender-matching potential antecedent with the ambiguous region fairly short. The pronoun was immediately

disambiguated by the subsequent verb. Since a search for the antecedent of a pronoun is not immediately triggered at the point of a pronoun, but is often delayed until subsequent words are encountered (Ehrlich & Rayner, 1983; Nicol & Swinney, 2002), the extent to which readers actually experience pronoun ambiguity might be limited in such cases. In Experiment 1, it was shown that grammatical subjects were accessible enough to be referred to with a pronoun even when the pronoun was ambiguous. What has yet to be answered is whether or not being the subject of a sentence grants enough prominence to the entity to be referred to with a pronoun even when ambiguity has a more extensive effect on the discourse. To address this question, in addition to the gender ambiguity, the ambiguous region length was increased to extend to the full clause in Experiment 2, as illustrated in (3c/3c').

3.
 - a. It was time for lunch.
 - b. Susan visited Emily briefly.
 - c. She/Susan bought two coffees // d. and handed one to Emily.
 - c'. She/Emily bought two coffees // d'. and handed one to Susan.
 - e. The coffee shop was crowded with office workers.
 - f. Who bought two coffees? 1. Emily 2. Susan

The accessibility-based accounts that give great weight to subjecthood in ranking accessibility would predict that a pronoun is a good candidate for coherently continuing the prominent subject antecedent, as pronouns are forms for signaling higher accessibility (Ariel, 1990; Gordon & Searce, 1995). On the other hand, if the disadvantage due to referential ambiguity overrides the preference to realize the most accessible entity as a pronoun, unambiguous names would be understood more easily than ambiguous pronouns. Given that previous studies on the interplay of ambiguity and accessibility are surprisingly few in number and are limited in scope in terms of how they defined ambiguity (e.g., Gordon & Searce, 1995; Tang & van Gompel, 2008), this study will be

the first to look at how coreference processing is affected by these two potentially competing accounts.

If there emerges the effect of ambiguity, also of interest in this study is whether referential ambiguity is a ‘bonding’ problem or a ‘resolution,’ or both in the two-stage model of anaphor resolution (Garrod, 1994; Garrod & Sanford, 1994). In a model proposed by Garrod and his colleagues, anaphor processing goes through two stages: in the stage of bonding, a low-level automatic link between anaphor and antecedent is formed, and in the resolution stage, the full semantic interpretation is finally accomplished.¹² In this study, as exemplified in (3c/3c’) and (3d/3d’), disambiguating information was presented to the reader downstream from the ambiguous pronoun. Thus, in region (3c/3c’), only bonding may occur as resolution cannot be completed. If building multiple and simultaneous bonds comes with processing cost, reading time will increase in this region as compared to the unambiguous counterpart. On the other hand, if referential ambiguity is a resolution problem, or the problem of deactivating competing interpretations, the difficulty will start to emerge in (3d/3d’). It is also conceivable that pronominal ambiguity slows down both stages of processing. Finally, if initial bonding considers only the most accessible entity on the basis of the subject assignment heuristic, the cost will only emerge in cases where the processor has to revise its initial bonding and resolve the pronoun to the object antecedent.

¹² The authors are not explicit about whether multiple bonds are allowed. I will assume that simultaneous bonds are possible; in this respect the two stages can be understood as the stage of constraining the initial candidate set of possible antecedents and the stage of eliminating nonreferents from the candidate set (Nicol & Swinney, 2002).

Method

Participants

The same participants from Experiment 1 participated in Experiment 2.¹³

Materials, Design, and Procedure

The stimuli consisted of twenty-four, five-clause passages like the one illustrated in (3) above. As in Experiment 1, there was a sentence providing the general context for the rest of the discourse (3a) and the sentence introducing discourse participants in the grammatical subject and object positions (3b). The characters were stereotypically of the same gender. There were four alternative versions of the third sentence, which was presented broken into two parts. The first clause contained either pronoun or name anaphors. The use of pronouns was ambiguous throughout the region and the name anaphors had either the subject or the object of the previous sentence as its antecedent. The second clause completed the sentence and served as disambiguation for the pronoun condition. In one condition, the pronoun was disambiguated toward the subject antecedent, and in another, the pronoun was disambiguated toward the object antecedent. Unlike in Experiment 1, semantic disambiguation of pronominal reference was not presented until the second half of the critical sentence in the pronoun condition. The last sentence (1f) was the wrap-up sentence of the passage.

Comprehension questions that required resolution of the coreference relation were asked after each passage as illustrated in (3f). The choices were the names of subject and

¹³ The experimental items from Experiments 1 and 2 were included in the same list. Because the two experiments were different in terms of ambiguity and because they had totally different sets of passages in their content, character names, and the main verbs used in the sentences introducing antecedents, it was expected that each set will be able to serve as fillers for the other experiment. A large number of “pure” fillers (n=86) was also included to prevent the experimental items from standing out.

object characters introduced in the second clause; the order of presentation was counterbalanced between items. The inclusion of comprehension questions allowed the investigation of whether differences in the on-line measure, if any, would translate into differences in the off-line measure of final interpretation.

In addition to these experimental passages, there were 110 filler passages. These fillers consisted of four- or five-clause discourses. Twenty-four of the filler passages served as the stimuli for Experiment 1. About a third of the filler passages contained comprehension questions. Four lists were created as described in Experiment 1. Experiment 2 was run in the same manner as Experiment 1. The experimental passages are listed in APPENDIX A.

Results

Reading Times at the Critical and Passage-final Sentences

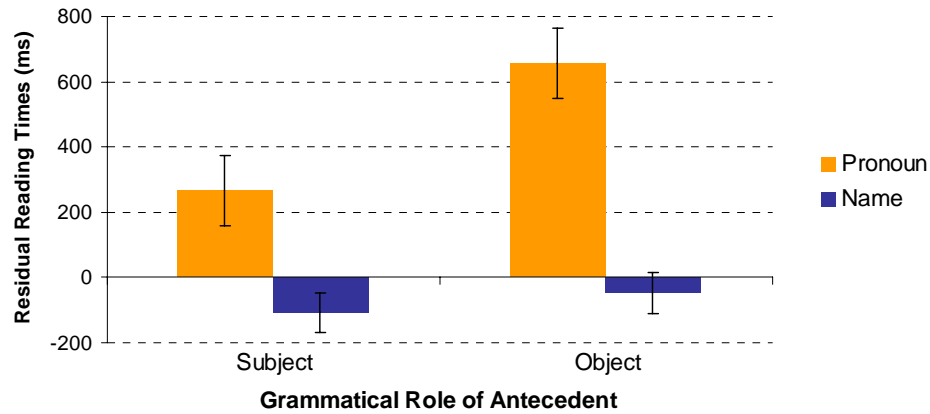
The critical sentence was presented in two parts: the first clause containing the anaphor and the second clause completing the first clause which served as the disambiguation for the pronoun condition. At each region, the reading time predicted by the participant's regression equation was subtracted from the actual raw reading time after removing outliers to obtain a residual reading time. Trimming of outliers were based on the same criteria as in Experiment 1: Raw reading times that had shorter than 500 ms in the given region or in the previous regions were removed and reading times longer than 5000 ms were replaced with the cut-off value. This affected 0.9% and 2.4% of the data from the first and second clause, respectively.

In the first clause, the experimental conditions did not result in any significant main or interaction effects. The best-fitting model ($r^2=.27$, $\kappa=4.06$) for the second half of

the critical sentence included antecedent, and anaphor, along with their interactions, and trial number as fixed effects with both subject and item entered as random effects (random intercepts only). All the fixed predictors contributed significantly to the model as summarized in Table 2. There was a significant effect of the grammatical role of the antecedent: residual reading times were shorter when the subject anaphor of the critical sentence referred to the subject of the previous sentence than when it referred to the object of the previous sentence. The type of the anaphor was significant as reading times were significantly shorter when the critical sentence contained a name than when it contained a pronoun. There also was a significant interaction between the grammatical role of the antecedent and the type of the anaphor such that the second half of the critical sentence was read significantly more slowly when a pronoun was disambiguated toward the object antecedent than when it was disambiguated toward the subject. Names were processed equally fast regardless of antecedent. These results are summarized in Figure 2. Finally, the increase in trial numbers led to faster reading times suggesting that participants got familiarized with the task as the experiment proceeded.

Table 2
Linear Mixed Model Output for the Residual Reading Times at the 2nd Half of the Critical Sentence (Experiment 2)

	Estimate	Std. Error	<i>t</i> value	Pr(> <i>t</i>)
(Intercept)	301.96	73.48	4.11	0.00**
Trial	-1.6	0.66	-2.41	0.02*
Grammatical Role of Antecedent (GR)	116.37	23.85	4.88	0.00**
Type of Anaphor (ANA)	-259.26	23.95	-10.82	0.00**
GR × ANA	-90.82	23.88	-3.80	0.00**



(Error bars represent 95% confidence intervals)

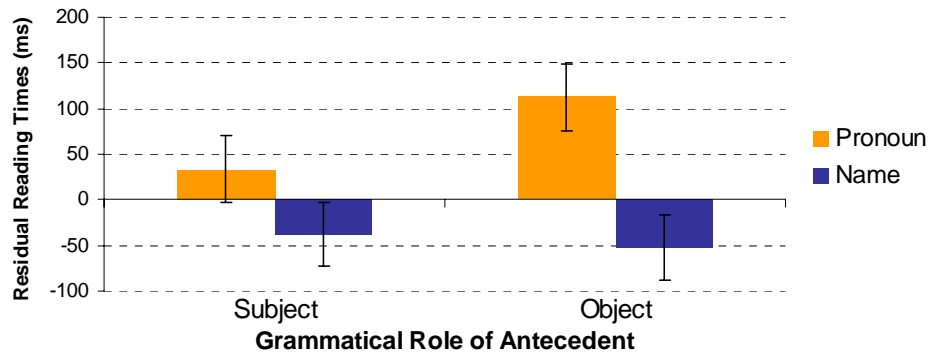
Figure 2. Residual reading times at the 2nd half of the critical sentence (Experiment 2)

The effect of anaphor and its interaction with antecedent persisted in a significant fashion in the final sentence of the passage, which wrapped up the passage without referring to any of the characters either by pronouns or names. As summarized in Table 3 and Figure 3, the fitted model ($r^2=.16$, $\kappa=3.96$) revealed that this region was read faster when the preceding critical sentence contained a repeated name anaphor than when it contained a pronoun. The difficulty associated with disambiguating the pronoun to the object antecedent relative to the subject antecedent persisted in this region.

Table 3

Linear Mixed Model Output for the Residual Reading Times at the Passage-final Sentence (Experiment 2)

	Estimate	Std. Error	<i>t</i> value	Pr(> <i>t</i>)
(Intercept)	134.07	45.01	2.98	0.00 ^{***}
Trial	-1.71	0.41	-4.15	0.00 ^{**}
Type of Antecedent (GR)	20.91	14.84	1.41	0.16
Type of Anaphor (ANA)	-50.52	14.91	-3.39	0.00 ^{**}
GR × ANA	-30.06	14.85	-2.02	0.04 [*]



(Error bars represent 95% confidence intervals)

Figure 3. Residual reading times at the passage-final sentence (Experiment 2)

Reading times from the first two sentences (i.e., the sentence providing the context for the passage and the sentence introducing discourse characters) did not vary significantly depending on the experimental manipulations.

Question Response Accuracy

The accuracy data were analyzed using mixed logit models.¹⁴ The best fitting model ($D_{xy}=0.45$)¹⁵ included the trial number, the grammatical role of the antecedent, and the type of the anaphor as fixed predictors with subject and item as random factors. As summarized in Table 4, the model revealed a significant effect of antecedent:

¹⁴ The standard way of analyzing categorical data in psycholinguistics has been using analysis of variance (ANOVA) over proportions. However, it has been pointed out that the use of ANOVAs for non-linear, categorical outcomes has serious problems (Dixon, 2008; Jaeger, 2008). Importantly, categorical outcomes do not meet the key assumption of normal distribution of ANOVA. Also proportions are bounded within the range of 0 and 1, whereas ANOVA's confidence intervals can extend beyond what actually can occur, which makes the results hard to interpret (Dixon, 2008; Jaeger, 2008). Another limitation is that when categorical data are transformed into proportions, the information on how many observations contribute to the calculation of the proportion is lost (Baayen, 2008). Logit analyses can get around these problems because they assume that the data are binomially distributed and because they model probabilities in unbounded log odds space (see Dixon, 2008; Jaeger, 2008, for details).

¹⁵ Somers' D_{xy} is a measure of goodness of model fit, which gives the rank correlation between predicted probabilities and observed responses (Jaeger & Kuperman, 2009). It has a value between 0 (random) and 1 (perfect correlation).

comprehension questions were answered significantly more accurately in the subject antecedent condition than in the object antecedent condition. The effect of the type of the anaphor was also significant, indicating higher accuracy in the name condition than in the pronoun condition. The results are graphically represented in Figure 4 based on the proportions of correctly answered trials for ease of illustration even though logit models are not performed over proportion data. Accuracy also increased as the trial number increased. Modeling for log transformed question response times did not yield any significant predictors.

Table 4
Mixed Logistic Model Output for Question Response Accuracy (Experiment 2)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	1.45	0.23	6.35	0.00***
Trial	0.01	0.00	2.31	0.02*
Grammatical Role of Antecedent (GR)	-0.44	0.11	-4.19	0.00***
Type of Anaphor (ANA)	0.26	0.10	2.58	0.01*
GR × ANA	-0.02	0.10	-0.24	0.81

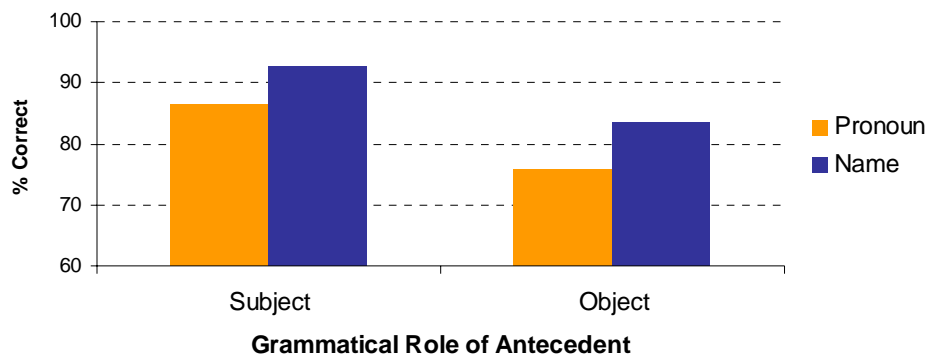


Figure 4. Question response accuracy (Experiment 2)

Discussion

The experiment investigated how the relative prominence of potential antecedents influences the processing of repeated names and pronouns when the ambiguity of the pronoun had a more global effect on the discourse. As in Experiment 1, readers preferred

to interpret ambiguous pronouns as coreferential with the subject antecedent, as shown by faster reading times when the pronoun was disambiguated toward the subject than to the object in the disambiguation region. This effect spilled over to the following region and led to better comprehension. These results provide strong evidence that the subject assignment strategy operates as the default for interpreting ambiguous pronouns and leaves a lasting effect when it is not supported by the following information.

The results of the experiment run counter to the argument that a repeated name penalty would occur also with syntactically ambiguous pronouns. In the present study, names led to faster reading times in the second half of the critical sentence and also in the wrap-up region as compared with pronouns, in both the subject and object antecedent conditions. Readers also arrived at a more stable representation of the discourse when the passages contained a name than when they contained a temporarily ambiguous pronoun. These results indicate that the processing of a pronoun is hampered when its referent cannot be easily identified; the subject assignment strategy may serve as the effective and fast default, but it still does not completely wipe out the effect of ambiguity. Centering theory emphasizes that referring to the most accessible entity in the preceding sentence using a pronoun should help connecting the current sentence to the one before. For the very same purpose of creating a connection between sentences, however, the language comprehender may prefer unambiguous names to ambiguous pronouns.

Interestingly, the effect of referential ambiguity did not emerge in the ambiguous region. Given that the reading times in the disambiguating region were longer for pronouns regardless of the grammatical role of the antecedent, we can rule out the possibility that the referential ambiguity went unnoticed. The results may indicate that

during the bonding process multiple and simultaneous interpretations can be built automatically without any measurable processing cost (Nieuwand & Van Berkum, 2008; Tang & van Gompel, 2009; Vonk, 1984). In addition, the weight of bonds may vary depending on, for example, the relative accessibility of the candidate antecedents as shown in the greater cost when the pronoun was disambiguated towards the object. The results support the view that referential ambiguity may challenge the processor when it is forced to commit to a full referential interpretation of the pronoun (Greene et al., 1992).

General Discussion: Experiments 1 and 2

Experiments 1 and 2 investigated whether an ambiguous pronoun is interpreted as referring to the more accessible entity in the discourse, and whether the argument that the most accessible discourse entity in the local discourse is preferentially realized as a pronoun instead of name generalizes to contexts where the use of a pronoun is grammatically ambiguous. Experiment 1 and 2 differed in terms of the scope of pronominal ambiguity and Experiment 2 further explored which stage of processing ambiguity incurs processing cost.

The advantage of subjecthood seems closely related to the preference for the continue transition over the shift continue transition. Generally the results of the two experiments provide support for the prediction that a sentence that continues the preceding subject is preferred to one that shifts the preceding subject. In both Experiments 1 and 2, faster reading times were observed for continues than for shifts. This observation was reliable in both the pronoun and name conditions in Experiment 1, but in Experiment 2, the two transitions were significantly different only in the pronoun

condition. Higher comprehension accuracy in the continue condition than in the shift condition regardless of the anaphor type in Experiment 2, however, suggests that continues indeed lead to a better discourse representation than shifts. The advantage of continues can be understood in terms of the role of the subject position as signaling a coherent link between two adjacent utterances (Walker et al., 1998), which seems to motivate the subject assignment strategy of interpreting ambiguous pronouns.

The results from both Experiment 1 and Experiment 2 clearly support the view that ambiguous pronouns are interpreted as coreferential with the more accessible entity in the discourse, with the subject being more accessible than the object. The results suggest that the local discourse structure in which the relative prominence of discourse entities is weighed guides the processing of a pronoun before all the semantic information is considered to identify the referent of the pronoun.

The prediction that pronouns would have an advantage over repeated names to refer to an entity in the subject position was not confirmed in the present study. Previous studies have claimed that even when the pronoun does not uniquely single out its referent based on morphological cues, the subject in a local discourse segment is preferentially realized as a pronoun rather than as a repeated name (Gordon & Searce, 1995; Hudson-D’Zmura & Tannenhaus, 1998). In the current study, however, a repeated-name penalty was not found for either antecedent type not only in Experiment 2 where the ambiguity of a pronoun had a stretching effect on the discourse, but also in Experiment 1 where the ambiguity of a pronoun was resolved semantically soon after the pronoun was encountered.

Previous studies in support of a repeated name penalty for ambiguous pronouns used materials similar to those used in Experiment 1; in those studies and in Experiment 1, pronouns were grammatically ambiguous but were semantically disambiguated by the immediately following verb. In Experiment 1, however, both types of anaphors were processed equally fast in the subject antecedent condition, in which previous studies argued for the advantage of pronouns. The discrepancy seems to come in large part from the way the experimental passages was constructed.

As summarized in Table 5 for ease of comparison, there are only two studies that found the repeated name penalty with ambiguous pronouns (Gordon & Searce, 1995; Hudson-D'zmura & Tanenhaus, 1998).¹⁶ It can be noted, however, that there is an intervening sentence between the antecedent sentence and the critical sentence where names and pronouns were compared in Gordon and Searce's (1995) study. Both the subject and the object antecedents were realized as a pronoun in the intervening sentence. This raises the question of whether the observed cost associated with using a name instead of a pronoun was due to a preference to realize a prominent entity as a pronoun, as the authors claim, or due to a disfavored progression from a pronoun to name. Referring expressions usually take a full form to refer to a newly introduced entity in the discourse model and progress to a more reduced form when the entity continues to be talked about (Chafe, 1980). Unless there arises the need to explicitly specify the referent of an anaphor due to referential competitors or due to the increased distance between the antecedent and the anaphor, it is unnatural to regress back to a more explicit form (Chafe, 1980). Hudson-D'zmura and Tanenhaus's stimuli (1998) do not have the same problem,

¹⁶ The studies reviewed here are limited to those focused on inter-sentential coreference.

but considering that it was a small scale study reporting raw reading times with only 16 participants, it seems that more research is needed to better answer the question of whether the repeated name penalty should be found with grammatically ambiguous pronouns.

In addition, a close look at the previous studies reveals that the processing of different forms of anaphors is affected by referential ambiguity, which has been neglected in the original studies. As summarized in Table 5, the repeated-name penalty was originally observed when an unambiguous pronoun and a repeated name were compared (Gordon et al., 1993; Gordon & Chan, 1995; Hudson-D'zmura & Tanenhaus, 1998: Expt. 2). Interestingly, in those studies, names tended to be read more slowly than pronouns not only in the subject antecedent condition but also in the object antecedent condition, even though this tendency was not statistically reliable in the latter. In addition, the use of an unambiguous pronoun for an entity in the object position did not result in reliable reading time differences relative to the use of an unambiguous pronoun for the subject antecedent. On the other hand, the studies that extended the repeated-name penalty to ambiguous pronouns reported a repeated name penalty for the subject antecedent but a pronoun penalty for the object antecedent (Gordon & Searce, 1995; Hudson-D'zmura & Tanenhaus, 1998: Expt. 1). The review suggests that the magnitude of the effect of prominence on coreference processing is mediated or overridden by referential ambiguity.

Taken together, we can conclude that the processing of anaphors is guided by both the prominence of discourse entities and referential ambiguity. When the number and gender features of the pronoun would not serve as a lexical filter, the initial

assignment is strongly constrained by the relative prominence of the likely antecedents; subjecthood plays an influential role in enhancing an entity's prominence. The use of a pronoun for the most accessible entity in the discourse may provide continuity and help integrate the current utterance with the previous one (Gordon et al., 1993), but depending on the degree of referential ambiguity, the language processor may prefer a more explicit reference. The advantage of having unambiguous anaphors also is shown as a more stable representation of the discourse; referential ambiguity, despite only being temporary, appears to disrupt comprehension (Experiment 2).

By examining reading times to the ambiguous and disambiguating regions, Experiment 2 sought to find whether referential ambiguity is a problem with the initial bonding or with final resolution in the two-stage framework of anaphor processing. In Experiment 2, the effect of referential ambiguity did not appear in the ambiguous region, but only emerged when the reader had to choose one interpretation over another. Although few reading-time studies actually show a significant effect of a relevant manipulation of prior context at the point of the pronoun (Ehrlich & Rayner, 1983), it is not likely that the ambiguous pronoun was not yet processed in the ambiguous region considering that this region was fairly long (the average number of words was 6). The results are consistent with the view that the initial stage of anaphor processing is automatic, whereas the ultimate resolution of referential ambiguity may require additional processing resources (Garrod & Sanford, 1994; Greene et al., 1992).

Table 5
Summary of Studies on the Processing of Pronouns vs. Repeated Names

Study	Method	Pronoun Ambiguity	Material	Results	Findings
Gordon et al. (1993), Expt. 4	Self-paced reading, a T/F comprehension question for each passage	No	1. George jumped out from behind a tree and frightened Debbie. 2. He was surprised at her hysterical reaction. 3. <i>He/George</i> never thinks about how others might feel. (CONTINUE) 3'. <i>She/Debbie</i> screamed loudly and ran away. (SHIFT) 4. Practical jokes are not always fun for everyone.	- RN conditions slower than pronoun conditions ($p < .001$) - significant interaction between pronominalization and CONTINUE-SHIFT manipulations ($p < .025$) : 183 ms in 3 ($p < .001$) vs. 42 ms in 3' ($p > .20$) - SHIFT slower than CONTINUE in 4 (spillover)	A larger RNP in the CONTINUE condition than in the SHIFT condition
Gordon & Chan (1995), Expt. 2	Self-paced reading, a T/F comprehension question for each passage	No	1. Susan decided to give Fred a hamster. 1'. Fred agreed to take care of Susan's hamster for the weekend. 2. <i>She/Susan</i> told him exactly what to feed it. (CONTINUE) 2'. <i>She/Susan</i> was questioned at length by him about what to feed it. (SHIFT) 3. Hamsters get sick easily if they eat the wrong food.	- RN conditions slower than pronoun conditions ($p < .05$) - SHIFT slower than CONTINUE ($p < .05$) - a marginally significant interaction between the pronominalization and CONTINUE-SHIFT manipulations ($p = .051$) : 251 ms in 2 vs. 83 ms in 2'.	A larger RNP in the CONTINUE condition than in the SHIFT condition
Gordon & Searce (1995), Expt. 1	Self-paced reading, a T/F comprehension question for each passage	Yes	1. Bill wanted John to look over 2. some important papers. 3. He had to mail him 4. the documents by Monday. 5. Unfortunately, <i>he/Bill</i> 6. never sent the papers. (CONTINUE) 5'. Unfortunately, <i>he/John</i> 6'. never received the papers. (SHIFT) 7. As a result, the whole deal 8. fell behind schedule.	- RN conditions slower than pronoun conditions in 5/5' ($p < .005$) - significant interaction between the pronominalization and CONTINUE-SHIFT manipulations ($p < .01$) : about 110 ms RNP in 6 vs. about 160 ms pronoun penalty in 6'	RNP in the CONTINUE condition

Table 5 (cont.)

Study	Method	Pronoun Ambiguity	Material	Results	Findings
Hudson-D'zmura & Tanenhaus (1998)	Self-paced reading, judgments as to whether the target sentence makes sense in relation to the context sentence	Yes	Expt 1 (ambiguous pronouns): 1. Jack apologized profusely to Josh. 2. <i>He/Jack</i> had been rude to Josh yesterday. (CONTINUE) 2' <i>He/Josh</i> had been offended by Jack's comment. (SHIFT)	- SHIFT slower than CONTINUE ($p < .01$) - significant interaction between the pronominalization and CONTINUE-SHIFT manipulations ($p < .01$) : 317 ms RNP in 2 vs. 222 ms pronoun penalty in 2' - pronoun-SHIFT condition judged to be less coherent	RNP in the CONTINUE condition (also for SHIFT condition in the case of unambiguous pronouns)
		No	Expt 2 (unambiguous pronouns): 1. Irene confronted Wayne about the incident at school. 2. <i>She/Irene</i> believed that Wayne was involved. 2'. <i>He/Wayne</i> believed that Irene was involved.	- RN conditions slower than pronoun conditions ($p < .01$) - no difference in coherence judgment score	

CHAPTER 4

COREFERENCE PROCESSING IN KOREAN

As reported in the previous chapter, the results of Experiments 1 and 2 support the view that discourse entities that appear as the grammatical subject of a sentence are perceived as more accessible and are considered as a better antecedent of an anaphor than grammatical objects. In addition, it was shown that the subject position allows pronominal reference even in situations where the use of a pronoun does not syntactically identify a unique referent (Experiment 1). In English, however, the grammatical subject is most of the time the first-mentioned entity in a sentence, which has also been argued to be more accessible than any other later appearing entities (Gernsbacher & Hargreaves, 1988). Therefore, the subject role could be confounded with order of mention in English.

The relative contribution of grammatical role and order of mention on coreference processing can be better studied in languages where these two factors can be dissociated. Korean provides a good testing ground as it has a relatively free word order: the canonical word order in Korean is SOV, but scrambling allows other arguments or adjuncts to occupy the sentence initial position. The experiments described in this chapter explore the relative contribution of subjecthood and/or order of mention in making a particular referent a good antecedent of an anaphor.

Under the assumption that the more reduced an anaphoric expression is, the more accessible its referent has to be (Ariel, 1990; Gundel et al., 1993), Experiment 3 investigates accessibility through its effects on the ease of processing of pronouns. In Experiment 4, processing of more reduced referring expressions such as null pronouns is compared to the processing of less reduced referring expressions such as names in order

to explore the cross-linguistic applicability of the notion of a repeated name penalty (Gordon et al., 1993) as a window to accessibility. To preview the results, the data from the two experiments support the idea that subjecthood is more heavily weighted than order of mention. Finally, Experiments 5 addresses the issue of whether appropriate discourse contexts in which different word orders can be felicitously integrated can increase the influence of order of mention on accessibility.¹⁷

In addition to having a relatively free word order, Korean is a so-called *pro-drop* language. There has been a lot of work done on processing of overt pronouns but relatively less on processing of null pronouns. This lack of interest is in part due to the fact that the majority of psycholinguistic research has been primarily concerned with English, which does not contain null pronouns. Also there has been a widely held assumption that null pronouns are just covert counterparts of overt pronouns displaying similar characteristics of overt pronouns. Recent studies, however, suggest that null pronouns are not processed in the same way as overt pronouns (Alonso-Ovalle et al., 2002; Carminati, 2002; Christianson & Cho, 2008). The study on Korean therefore is expected to help shed light on the issue of how processing of null pronouns is different or similar to the processing of overt pronouns.

With these broad goals in mind, this chapter reports three experiments that are designed to determine the contribution of grammatical role and word order in the

¹⁷ In Gernsbacher and colleagues' original work, the surface order itself was emphasized in explaining the privileged status of the first-mentioned entity in a sentence. However, discourse-old information, or a topic, tends to appear in the sentence initial position cross-linguistically (Lambrecht, 1994), which is not necessarily a subject in a flexible word-order language. Given that word order variation in many languages is motivated by information-structural reasons, any effect of word order variation can be better understood in terms of the information structure associated with it.

processing of coreference in Korean. Before reporting the experiments, the next section briefly summarizes relevant linguistic characteristics of Korean, focusing on the system of reference and word-order variations.

Linguistic Characteristics of Korean

Null Arguments

In Korean any argument in a finite clause can be realized as a null element as illustrated in (1). In addition, its content is not identifiable based on agreement morphemes on the verb. In this respect, Korean null arguments are different from *pro*-drop in languages like Italian and Spanish which allow subjects of finite clauses to be null but their referential value can be recovered based on rich agreement morphology on the verb. One exception is honorific agreement, in which the verb agrees with the subject and/or the object; but still person, gender and number are not identifiable in Korean.

1. *ilkta* ‘to read’
 - a. *Cheli-ga chayk-ul ilkessta.*
 Cheli-NOM book-ACC read
 ‘Cheli read a book.’
 - b. *Cheli-ga [e] ilkessta.*
 Cheli-NOM read
 ‘Cheli read (it/them).’
 - c. *[e] chayk-ul ilkessta.*
 book-ACC read
 ‘(I/you/we/he/she/they) read a book.’
 - d. *[e] [e] ilkessda.*
 read
 ‘(I/you/we/he/she/they) read (it/them).’

Huang (1984, 1989) notes that null arguments in East-Asian languages are used when their referents are topical and recoverable by inference in a given context. He further proposed that null arguments are licensed by the parameter of [\pm discourse-

oriented] based on the observation that discourse-oriented languages share a cluster of related properties including topic prominence and topic deletion.¹⁸ In Huang's analysis, only embedded null subjects are *pro* bound by matrix NPs. Matrix null subjects and null objects are classified as variables bound by a zero topic operator. In this system, a variable is characterized as [-anaphor, -pronominal] in Chomsky's (1982) classification of nominal expressions given in (2).¹⁹

2.		Overt	Covert
	a. [+anaphor, -pronominal]	anaphor	NP-trace
	b. [-anaphor, +pronominal]	pronoun	pro
	c. [+anaphor, +pronominal]		PRO
	d. [-anaphor, -pronominal]	R-expression	variable

Under this analysis, whether a matrix subject or an object can drop or not depends on the occurrence of zero topics. In Huang's and several other works, a topic is assumed to be base-generated in the specifier position of the highest functional node, Topic Phrase (Chomsky, 1977; Huang, 1984; Zushi, 2003).

Not all researchers, however, have agreed on Huang's analyses of null arguments in East-Asian languages. Based on the observation that null arguments pattern with overt pronouns in a number of grammatical properties, other researchers have suggested that a null argument is a pronominal, regardless of whether it occurs as a subject or an object

¹⁸ Li and Thomson (1976) classify Korean as a language that is both subject prominent and topic prominent. In addition to the subject-predicate construction, Korean uses the topic-comment construction in which topics occur sentence initially and can be marked by explicit morphology (with topic marker '-(n)un'). Topics are often not realized at the surface level and pick up their referent from discourse. The topic markers and case markers in Korean do not stack together, and any constituent can be topic-marked.

¹⁹ In Lasnik's (1991) reformulation of the classification, variables are considered as the null counterparts of epithets:

a.	[-pronominal, +referential]	R-expressions
b.	[-pronominal, -referential]	anaphors
c.	[+pronominal, +referential]	epithets
d.	[+pronominal, -referential]	pronouns

(Cole, 1987; Hoji, 1998; Moon, 1989; Zushi, 2003). Yet others have proposed that null arguments are derived by application of argument ellipsis or NP-deletion (Kim, 1999; Saito, 2007). A full discussion on the status of null arguments in Korean or in East-Asian languages is beyond the scope of this dissertation. For ease of reference, the terms ‘null pronoun’ and ‘*pro*’ will be interchangeably used to refer to null subjects in Korean throughout this dissertation.

Korean also has phonetically overt pronouns as well as null pronouns which distinguish person and number. Gender is distinguished only in the 3rd person pronouns (*ku* ‘he,’ *kunye* ‘she’). The use of overt 3rd person pronouns, however, is rare in colloquial speech.

Word Order Variation

Korean is a head-final language; the canonical word order is SOV. However, arguments and adjuncts can scramble freely in a sentence as long as the verb retains the final position as shown in (3). Grammatical relations among constituents are indicated by case-marking particles.

3. a. *Swunhi-ga* *kongwen-eyse* *Inho-lul* *mannassta*
 Swunhi-NOM park-LOC Inho-ACC met
 b. *Swunhi-ga* *Inho-lul* *kongwen-eyse* *mannassta*
 Swunhi-NOM Inho-ACC park-LOC met
 c. *Inho-lul* *Swunhi-ga* *kongwon-eyse* *mannassta*
 Inho-ACC Swunhi-NOM park-LOC met
 d. *Inho-lul* *kongwon-eyse* *Swunhi-ga* *mannassta*
 Inho-ACC park-LOC Swunhi-NOM met
 e. *kongwon-eyse* *Swunhi-ga* *Inho-lul* *mannassta*
 park-LOC Swunhi-NOM Inho-ACC met
 f. *kongwon-eyse* *Inho-lul* *Swunhi-ga* *mannassta*
 park-LOC Inho-ACC Swunhi-NOM met
 ‘Swunhi met Inho at the park.’

Although all the permutations have the same propositional interpretation, each word order conveys slightly different information structure only appropriate to a specific discourse situation (Chang, 1996). Generally speaking, the sentence-initial position is associated with the topic, a discourse-old or situationally evoked discourse entity. The position immediately preceding the verb, on the other hand, is associated with the focus, or new information (Chang, 1996; Sohn, 1999). This preverbal position bears the main stress of the sentence in a neutral context or in cases where the entire sentence is the focus (Jun, 1993, 2006).

When scrambling is motivated by this given-new ordering, the object serving as old information can be scrambled out of the focus domain resulting in the OSV order (Choi, 1996; for Japanese, see Ferreira & Yoshita, 2003; Ishihara, 2000). There is, however, another information-structural constraint that may motivate scrambling. Choi (1996) and Ishihara (2000) observe that scrambling can encode prominence with the preverbal nucleus stress switched to the scrambled element. Deaccented preverbal position in this case receives a given interpretation. To summarize, scrambling of an object may yield two different interpretations as illustrated in (4).

4. *Inho-lul* *Swuni-ka* *mannassta.*
 Inho-ACC Swuni-NOM met
 a. OŚV: Scrambling motivated by givenness [out of the focus domain]
 “As for Inho, Swuni met him.”
 b. ÓSV: Scrambling motivated by prominence [out of the givenness domain]
 “It is Inho (among other people) who Swuni met.”

Experiment 3

Experiment 3 investigated the interpretation of null pronouns in Korean under the assumption that they are resolved guided by the relative accessibility of discourse entities

(Ariel, 1988, 1990, 1996; Gundel et al., 1993; Groz et al., 1995; Walker et al., 1998).

Null pronouns in Korean are grammatically ambiguous and their interpretation relies heavily on the discourse context. In a local discourse, it can be argued that the relative accessibility of discourse entities generates an internal context from which the identities of *pro*'s referents can be inferred, as has been suggested in the processing of ambiguous overt pronouns (e.g., Crawley & Stevenson, 1990; Gordon et al., 1993). In this experiment, accessibility was manipulated based on grammatical role and order of mention.

Participants read passages like (5). A temporarily ambiguous *pro* in (5b) was disambiguated in (5c/c') either toward the subject or the object NP in the preceding sentence (5a/a'), which was presented in either SOV or OSV order. A probe question (5d) then asked the referent of the *pro*.

5. Antecedent sentence in SOV (a) vs. OSV (a')

- a. *Sanghwun-ika Yengsik-ilul chwukku kyengkichwung kongkyekhayssta.*
Sanghwun-NOM Yengsik-ACC soccer game-during attacked
a'. *Yengsik-ilul Sanghwun-ika chwukku kyengkichwung kongkyekhyassta.*
Yengsik-ACC Sanghwun-NOM soccer game-during attacked
"Sanghwun attacked Yengsik during a soccer game."

Ambiguous *pro*

- b. *pro tim-uy mitupilte-yessnunte,*
team-GEN midfielder-was-and
"He was the midfielder of the team,"

Disambiguation toward the subject (c) or the object (c')

- c. *Yengsik-iuy kong-ul ppayssulye hayssta.*
Yengsik-GEN ball-ACC snatch-try did
"tried to snatch the ball from Yengsik"
c'. *Sanghwun-iuy kong-ul ppayssulye hayssta.*
Sanghwun-GEN ball-ACC snatch-try did
"tried to snatch the ball from Sanghwun"

Comprehension question

- d. *Nwu-ka tim-uy mitupilteyessna?*
Who-NOM team-GEN midfielder-was-INTERR
"Who was the midfielder of the team?"
1. *Sanghwun* 2. *Yengsik*

A great deal of work has shown that subjects are more accessible than entities in other grammatical positions, and hence are preferred as antecedents for ambiguous pronouns (Gordon et al., 1993; Mathews & Chodorow, 1988). There also is evidence suggesting that the first-mentioned entity in a sentence is more accessible than other later appearing entities (Gernsbacher, 1990; Gernsbacher & Hargreaves, 1988; Gernsbacher et al., 1989). As pointed out earlier, however, in a rather strict word-order language like English, with syntactic subjects occupying the sentence-initial position most of the time, grammatical role is often confounded with order of mention. Therefore, there is a limitation on the extent to which the notions of subjecthood and first mention can be untangled.

In a few studies on languages where order of mention and grammatical position can be dissociated, like Finnish and Turkish, there have been mixed findings regarding how each factor affects the interpretation of an ambiguous pronoun. For example, Järviö et al. (2005) showed that both order of mention and grammatical role independently have effects on pronoun resolution in Finnish. Hoffman's (1998) study on Turkish, on the other hand, did not find an effect of word order. Kaiser (2003) points out that the discourse functions of scrambling vary across languages and this may in part explain the seemingly conflicting data. As mentioned above, scrambling in Korean is largely motivated by the givenness or prominence of the scrambled constituent. Therefore, in OSV, it can be hypothesized that the initial object is made more available for subsequent pronominalization through scrambling.

If subjecthood is the determining factor of referent accessibility in Korean, ambiguous null pronouns will be interpreted as referring to preceding subjects

independently of word order. As a result, difficulty will be experienced when disambiguation is made toward object as in (5c') as compared with when disambiguation is made toward subject as in (5c). In contrast, if first mention (and its role in the information structure) determines referent accessibility regardless of syntactic role, the prediction is that the ambiguous pronoun in (5b) will be interpreted to refer to the first entity in the preceding sentence (5a), resulting in processing advantage when disambiguation is made toward subject (5c) in SOV and toward object (5c') in OSV. Another possibility is that these two factors are both relevant and contribute to referent accessibility, and hence the likelihood of subsequent *pro*-drop. In this case, the interaction between grammatical role and order of mention should be visible in the OSV word order where the two factors yield different predictions. We can hypothesize that both subject and object interpretations are activated in the OSV order and hence both types of disambiguation will be processed equally easily under the assumption that there is no difference in terms of the weight of the two factors.

In order to provide insight to the questions sketched out above, this study investigates the relative contribution of grammatical role and word order in the resolution of ambiguous *pro* in Korean. The primary data sources are the reading times spent at the disambiguation region (5c/c') and the accuracy in the antecedent identification questions (5d). The reason for taking the accuracy data as one of the primary sources of information is based on the observations that any difficulty associated with revising initial misanalyses may lead to higher misinterpretation rates (Christianson et al., 2001; Ferreira, 2003). Comprehension questions can encourage readers to engage in deep

processing, but can be useful in tapping into the resolution process (Greene et al., 1992; Stewart et al., 2007).

Method

Participants

Forty-four native speakers of Korean participated in the study (26 females). They were paid \$5 for participating.²⁰ The data from 4 participants were discarded due to more than 20% error rates on comprehension questions collapsed across the experimental and filler items. The mean accuracy of the remaining 40 participants was 89.8%.

Materials

Example (5) above illustrates the stimuli in each condition. The experiment employed a self-paced reading task. The experimental items (n=24) were created according to a 2×2 design with two within-subject factors: word order (SOV vs. OSV) and grammatical role of the disambiguated antecedent (toward subject vs. toward object). The first sentence of the passage introduced two characters by name in either SOV or OSV order. The names were stereotypically of the same gender and served as potential antecedents for the temporarily ambiguous null pronoun in the next region. To control for verbal causality effect (Garvey et al., 1975), the verbs were selected based on a sentence-completion task. Eighty interpersonal transitive verbs in Korean were embedded in sentence fragments of the form “Subject-Object-Verb. Because ____.” A separate group of 40 participants were asked to complete the ‘because’ clause. None of the selected verbs had more than 60% completions favoring either subject or object.

²⁰ Although all the Korean participants in this study were recruited in the US, they had lived in Korea at least up to puberty, and reported Korean as their first and most dominant language.

The second sentence consisted of two clauses: the first clause contained a null pronoun and the second clause disambiguated the referent of the null pronoun either toward the subject or the object in the preceding sentence. The interpretation questions then asked the referent of the pronoun. The names of the subject and object characters were given as choices and their order of presentation was counterbalanced. Seventy-two fillers were also constructed. These fillers contained various stories of discourse participants engaged in some activity, and various types of anaphors like occupational titles, names, overt pronouns, and null pronouns were used. A comprehension question requiring understanding of various parts of the passages was asked after each filler item.

Four versions of each experimental item were created and four different lists were created from these experimental and filler items using the Latin Square design. Eight practice items were created and presented at the beginning of each list. The experimental passages are listed in APPENDIX B.

Procedure

Participants were seated in front of a computer and instructed to position their hands over a button box with '1', '→', and '2' labels. A trial began with an arrow presented on a computer monitor, and the passages were presented one clause at a time. Participants controlled the rate of presentation by pressing the arrow button. When participants pressed the arrow button, the current clause disappeared from view and was replaced by the next clause until the question and choices were presented. Participants were instructed to answer the questions by pressing '1' or '2' as appropriate. They were also told to read the passages at a normal pace and to answer the comprehension questions as quickly as possible. After eight practice items participants were asked if they

had any further questions about the task. Reading times for each region, button press latencies to answer comprehension questions, and responses to the questions were recorded. The session lasted approximately 30 minutes.

Results

The data were analyzed for residual reading times at the disambiguation region, question-answering latencies, and the accuracy with which participants answered the comprehension questions. Residual reading times for the antecedent sentence and the *pro*-clause were also analyzed.

Residual Reading Times at Disambiguation

Trials with less than 500 ms reading times at this region or in the previous regions were excluded from the analyses resulting in the removal of 3.02% of the data. Then reading times longer than 7500 ms were replaced with the cut-off value. This affected 1.56% of the data. A mixed-effects model was fit to the data with word order, grammatical role of the disambiguated antecedent, and their interactions as fixed factors and subject and item as random factors (Baayen et al., 2008).²¹

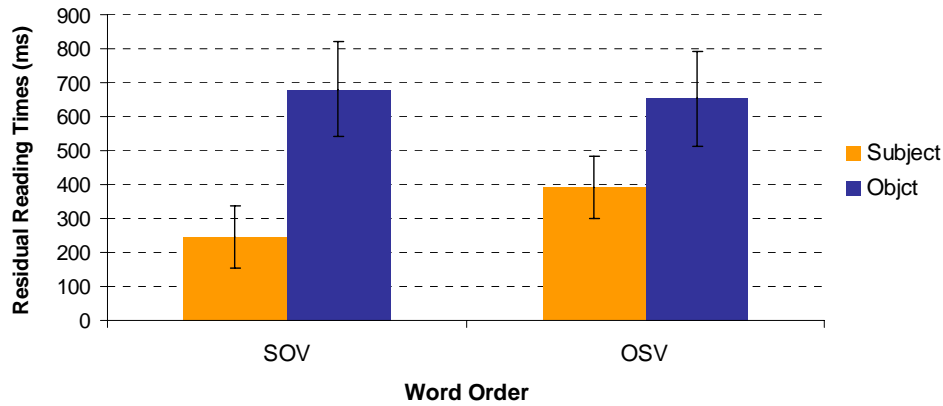
The model ($r^2=.14$, $\kappa=1.48$) yielded grammatical role as a significant predictor as reported in Table 6. Regardless of word order, reading times were faster when *pro* was disambiguated toward the subject of the preceding sentence than when *pro* was disambiguated toward the object of the preceding sentence. This pattern is summarized graphically in Figure 5.

²¹ Trial number as a fixed factor did not yield a significant effect, and hence was not included in the final model. Although word order and its interaction with grammatical role did not contribute to the model, they were retained in order to allow a comparison of the results from other analyses. The models with or without these predictors were substantively almost the same. The list parameter as a random factor was not justified in the model comparison and hence was not included.

Table 6

Linear Mixed Model Output for the Residual Reading Times at Disambiguation (Experiment 3)

	Estimate	Std. Error	<i>t</i> value	Pr(> <i>t</i>)
(Intercept)	490.55	83.24	5.89	0.00**
Word Order (WO)	26.28	40.83	0.64	0.52
Grammatical Role (GR)	174.02	40.77	4.27	0.00**
WO × GR	-41.04	40.83	-1.01	0.32



(Error bars represent 95% confidence intervals)

Figure 5. Residual reading times at disambiguation (Experiment 3)

Residual Reading Times at the Antecedent Sentence: SOV vs. OSV

Reading times were significantly longer in the scrambled OSV order than in the canonical SOV order ($t=4.31$, $p<.01$). The mean residual reading times were -55.12 ms in SOV and 458.99 ms in OSV. Also reading times got significantly shorter as the trial number increased ($t=-4.08$, $p<.01$).

Residual Reading Times at the Pro Clause

Only the effect of trial was significant at this region ($t=-4.55$, $p<.01$).

Question Response Accuracy

Accuracy data from the questions probing the antecedents of temporarily ambiguous null pronouns were analyzed using mixed logit models (Dixon, 2008; Jaeger,

2008). As summarized in Table 7 and Figure 6,²² the selected model ($D_{xy}=.60$) yielded a reliable two-way interaction between word order and grammatical role, such that in the OSV order, questions were answered more accurately when the *pro*'s referent turned out to be the object NP than when it turned out to be the subject NP in the antecedent sentence. The main effect of grammatical role was significant as the overall accuracy was higher in the object antecedent condition than in the subject antecedent condition. This main effect was implicated in the interaction, however, and as such does not merit further discussion on its own. Finally, comprehension questions were answered significantly more accurately as the trial number increased.

Table 7

Mixed Logistic Model Output for Question Response Accuracy (Experiment 3)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	0.80	0.24	3.40	0.00**
Trial	0.01	0.00	3.50	0.00**
Word Order (WO)	0.08	0.09	0.91	0.36
Grammatical Role (GR)	0.17	0.09	2.04	0.04*
WO × GR	0.20	0.09	2.29	0.02*

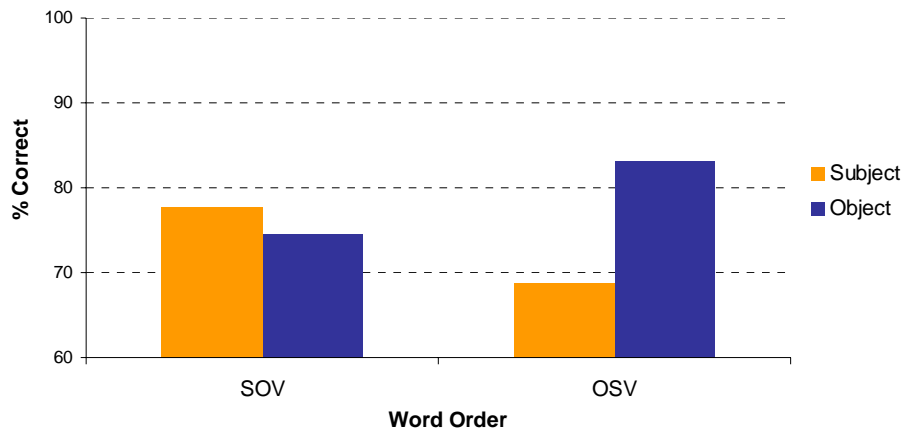


Figure 6. Question response accuracy (Experiment 3)

²² Figures were plotted in % correct responses for ease of conceptualization even though the logit models were run on actual counts.

Question Response Times

Question response times longer than 7000 ms were replaced with the cutoff value, which affected 2.5% of the data. A mixed-effects model was performed on log-transformed question response times including trial, question accuracy, and the experimental manipulations (word order and grammatical role) as fixed factors and subject and item as random factors. It was revealed that questions tended to be answered significantly more slowly when participants responded to the comprehension questions incorrectly than when they answered correctly ($t=-6.26, p<.01$). A separate mixed-effects model was fit to the data with only correctly answered trials. It was revealed that decision times were longer in the OSV conditions than in the SOV conditions ($t=1.97, p<.05$). Also questions tended to be answered significantly more quickly as the experiment proceeded ($t=-4.61, p<.01$).

Discussion

The experiment was conducted in order to better understand how the grammatical role of discourse entities and the order in which the entities are introduced affect the likelihood they are considered as an antecedent of *pro* in Korean. The on-line data from the reading times at the disambiguation region summarized in Figure 5 provide evidence in support of a preference for subject antecedents (Gordon et al., 1993; Mathews & Chodorow, 1988). Participants experienced more difficulty in the conditions in which the *pro* turned out to refer to the object NP, which can be interpreted as difficulty associated with revising the initial association of *pro* with the subject. Interestingly, this was true collapsing across the SOV and OSV orders, suggesting that first mention does not drive the initial process of interpreting *pro*.

This subject preference, however, was not mirrored in question response accuracy. Instead of overall higher accuracy in subject antecedent conditions regardless of word order, within the OSV order, response rates were less accurate when *pro* was disambiguated to the subject NP than when it was disambiguated to the object NP. Since scrambling of an object NP to the sentence initial position is generally recognized as connected to givenness or prominence (Choi, 1996; Ishihara, 2000), the results can be interpreted as indicating that participants were better at comprehending sentences in which *pro* was disambiguated to the given/prominent antecedent.

In the canonical SOV order, no clear advantage of either antecedent condition was revealed in the accuracy data. It can be speculated that no particular discourse-based presuppositions are needed in the canonical SOV order, and hence even the disambiguation toward the object NP does not seem to cause particular trouble for coming to grips with the final interpretation. Taken together, the patterns of on- and off-line data suggest that even though the subject antecedent is assigned to *pro* in the initial parse, the word order information is taken into account at the final interpretation stage in conjunction with grammatical role.

The results do not support a view that any single factor would determine referent accessibility and drive pronoun interpretation. Also the view that both factors would make equal contributions to the interpretation processes is not supported. The different patterns observed in the on- and off-line data reported here suggest that the word order information may have a later effect as compared to the early effect of grammatical role information.

Experiment 4

In Experiment 3, the results from on-line measures revealed an overall preference to interpret null pronouns as referring to grammatical subjects, independent of whether the subject NP preceded or followed the object NP. Experiment 4 further investigates how subjecthood and order of mention impact accessibility, and how accessibility in turn affects the processing of referring expressions. Under the assumption that the more reduced a referring expression is, the more accessible its antecedent has to be, this experiment examines how the processing of name anaphors and null pronouns is affected by the two factors, grammatical role and order of mention, that have been claimed to be correlated with accessibility.

Using passages like (6), the processing of name and pronoun anaphors was compared in the critical sentence (6c/c'). The two characters in the previous sentence introduced in either the SOV (6b) or OSV order (6b') served as potential antecedents for the anaphor in the critical sentence. In (6c), the anaphor referred to the subject NP in (6b/b') and in (6c'), the anaphor referred to the object NP in (6b/b').

6. Passage-initial sentence

- a. *Aidul-i chwukku kyengki-lul hako issessta.*
kids-NOM soccer game-ACC play PAST.PROG
“Kids were playing soccer.”

Antecedent sentence in SOV (b) vs. OSV (b')

- b. *Kyengki chwung Sanghwun-ika Yengsik-ilul kongkyekhayssta.*
game-during Sanghwun-NOM Yengsik-ACC attacked
b'. *Kyengki-chwung Yengsik-ilul Sanghwun-ika kongkyekhayssta.*
game-during Yengsik-ACC Sanghwun-NOM attacked
“Sanghwun attacked Yengsik during the game.”

Critical sentence: *pro* vs. repeated name in continue (c) vs. shift (c')

- c. *pro/Sanghwun-ika Yengsik-iuy kong-ul kalochaylye hayssta.*
He/Sanghwun-NOM Yengsik-GEN ball-ACC snatch-try did
“*pro*/Sanghwun tried to snatch the ball from Yengsik.”

- c'. *pro/Yengsik-ika Sanghwun-iuy kong-ul kalochaylye hayssta.*
 pro/Yengsik-NOM Sanghwun-GEN ball-ACC snatch-try did
 “He/Yengsik tried to snatch the ball from Sanghwun.”

Passage-final sentence

- d. *Maywu kyengcayng-i simhassta.*
 very competitive-NOM intense-was
 “It was a very competitive game.”

As reviewed in Chapter 3, studies have demonstrated that an accessible discourse entity is preferentially realized as a pronoun rather than a repeated name in English, a phenomenon known as the repeated name penalty (Gordon et al., 1993). The generality of this finding in other languages, however, is not certain. One exception is Yang, Gordon, Hendrick and Wu (1999), which provides evidence for processing advantage of pronominal reference for expressions in subject position in Chinese. One of the goals of Experiment 4 is to test whether the notion of repeated name penalty is relevant also in Korean. If coreference is achieved more easily with null pronouns than with repeated names for a more accessible entity in Korean, as in English (and Chinese), the pronoun conditions should be read with greater ease than the name conditions when the pronoun refers to an accessible entity. In light of the results from Experiment 3 that suggest the prevailing effect of subjecthood in the on-line data, it is predicted that this advantage of pronominal reference, if any, should be visible in the subject antecedent condition.

Unlike in Experiment 3 where the ambiguity of *pro* was not resolved until the disambiguation was provided in the next clause, in Experiment 4, the referent of *pro* was designed to be immediately interpretable in the critical sentence: based on the name of the character mentioned in this region (usually in genitive or dative case) and the rest of the semantic information, readers could come to the conclusion that the other character should be the referent of *pro* in the subject position. Since Korean null pronouns are not

interpretable based on morphological cues, it is impossible to test the generality of the notion of repeated name penalties with grammatically unambiguous null pronouns in Korean. The sentences used in this experiment will instead help shed light on the way unreduced (such as repeated names) and reduced (such as null pronouns) are processed in situations where the referents of null pronouns can be easily identified, despite their grammatical ambiguity.

Method

Participants

Fifty-six native speakers of Korean took part in the experiment (25 females). They were paid \$7 for participating. The data from 8 participants were discarded due to more than 20% error rates on comprehension questions. The mean accuracy of the remaining 48 participants was 90.05%.

Materials and Procedure

A set of 48 four-sentence passages like the one shown in (6) above was constructed. There were eight alternative conditions by varying the order in which the antecedents were introduced in the second sentence (SOV vs. OSV), the grammatical role of the antecedent of the anaphor mentioned in the third (critical) sentence (subject vs. object), and the form of the anaphor (*pro* vs. repeated name). The two characters in the antecedent sentence were marked with a nominative and accusative case marker, respectively, when they were first introduced. When they were repeated in the critical sentence in the name condition, a nominative case marker was used. The names of the two characters in each experimental passage were conventionally of the same gender. These sentences were embedded between a sentence introducing the context for the

passage and a sentence closing the passage.²³ The experimental passages are listed in APPENDIX B.

The experimental passages were presented along with 90 filler passages. The fillers also consisted of four-sentence passages which included named and generic referents. About a half of the filler passages were followed by a comprehension question that required understanding of various parts of the passages. Eight lists of materials were constructed by assigning one of the eight versions of each experimental passage and the 90 filler passages to each list. An initial practice block consisting of 6 additional filler passages was presented before each list to familiarize participants with the self-paced reading task. The experiment was run in the same way as Experiment 3.

Results

The data were analyzed using mixed effects modeling for residual reading times at each region with the primary focus on the critical region which contained *pro* and name anaphors.

Residual Reading Times at the Critical Region

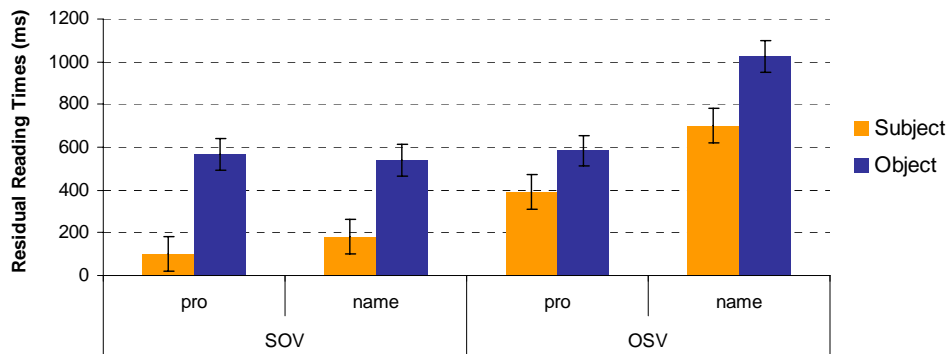
Outliers were trimmed based on the same criteria as in Experiment 3, which affected less than 2% of the data. A mixed effects model was fit to the data with word order (SOV vs. OSV), grammatical role of the antecedent (subject vs. object), type of

²³ Unlike in Experiment 3, comprehension questions were not asked in Experiment 4 in the experimental passages. Although accuracy from comprehension questions asking the referent of an anaphor was shown to be a useful off-line measure in Experiment 3 where the ambiguity of *pro* was not disambiguated until the next clause, it was expected that accuracy would easily reach the ceiling in Experiment 4 as the antecedent of an anaphor was immediately disambiguated. In addition, the comparison of Experiments 3 and 4 will help determine whether the effects obtained in Experiment 3 are relevant only when readers are encouraged to engage in deep processing, or also when they are reading without external need to resolve anaphoric references.

anaphor (*pro* vs. name), and their interactions as fixed factors, and subject and item as random effects. List was not included as a random effect in the final model as its inclusion was not justified in a likelihood ratio test. The results of the model ($r^2=.13$, $\kappa=5.35$) are summarized in Table 8. The mean residual reading times in each condition are graphically illustrated in Figure 7.

Table 8
Linear Mixed Model Output for the Residual Reading Times at the Critical Region (Experiment 4)

	Estimate	Std. Error	<i>t</i> value	Pr(> <i>t</i>)
(Intercept)	805.18	70.66	11.39	0.00**
Trial	-5.029	0.78	-6.41	0.00**
Word Order (WO)	168.14	25.66	6.55	0.00**
Grammatical Role (GR)	166.57	25.67	6.49	0.00**
Type of Anaphor (ANA)	107.65	25.70	4.19	0.00**
WO × GR	-35.66	25.66	-1.39	0.16
WO × ANA	83.95	25.66	3.27	0.00**
GR × ANA	-1.01	25.69	-0.04	0.97
WO × GR × ANA	16.60	25.71	0.65	0.52

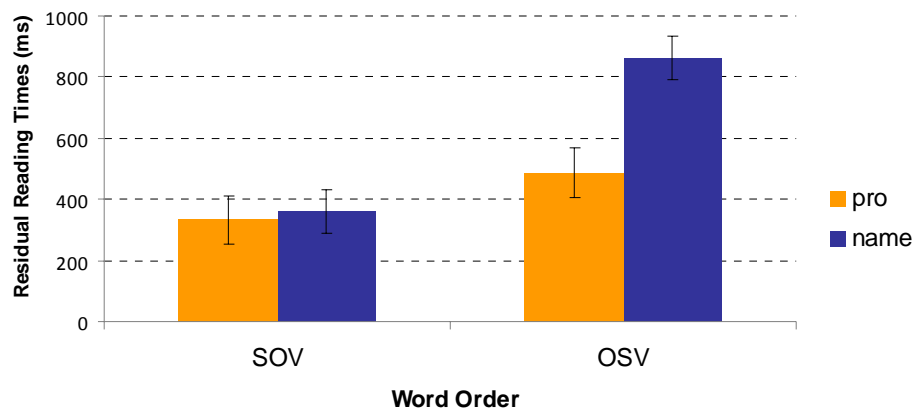


(Error bars represent 95% confidence intervals)

Figure 7. Residual reading times at the critical region (Experiment 4)

The effect of word order was significant in the model: this region was read faster when it followed the SOV antecedent sentence. The main effect of grammatical role was also significant: independent of word order and anaphor, participants slowed down when the object NP in the preceding sentence served as the antecedent for the anaphor in the

subject position of this region as compared with when the subject NP served as the antecedent. And the form of anaphor had a reliable effect such that null pronouns were read faster than repeated name anaphors. This main effect was driven mostly by the conditions in the OSV order as suggested by its reliable two-way interaction with word order. As represented in Figure 8, reading times between null pronouns and names were not significantly different from each other in SOV, whereas names were read significantly more slowly than null pronouns in OSV. Finally, the effect of trial was significant, suggesting that the more the experiment proceeded, the more participants got used to reading the material.



(Error bars represent 95% confidence intervals)

Figure 8. Interaction of word order and anaphor (Experiment 4)

Residual Reading Times at the Passage Final Sentence

Reliably faster reading times were observed in this region when the anaphor in the previous sentence (the critical sentence) had a subject antecedent than when the anaphor had an object antecedent ($t=2.85, p<.01$). The effect of anaphor was also significant such that reading name anaphors in the previous sentence led to significantly faster reading times in this region than reading null pronouns ($t=-3.65, p<.01$). Finally, the effect of trial

was significant ($t=-9.37$, $p<.01$). None of the interaction effects were significant at this point.

Residual Reading Times at the Antecedent Sentence: SOV vs. OSV

The canonical SOV was read significantly faster than the scrambled OSV order ($t=7.29$, $p<.01$). In average, the residual reading times were 593.2 ms longer in OSV than in SOV.

Residual Reading Times at the Passage-initial Sentence

No effect was significant at the passage initial sentence providing a general context for the rest of the passage.

Discussion

Overall, there was a subject preference regardless of word order for both anaphors as revealed by the main effect of the grammatical role of the antecedent and the lack of its interaction with any other factors. The results replicate the finding of Experiment 3 in that the subject preference is not limited to the SOV order. The object in the scrambled OSV order was still not preferred to be continued with an anaphor as compared with the subject. Furthermore, the results show that the preference is robust enough to be found in situations where the referent of an anaphor can be easily identified, which in theory can limit the effect of garden-pathing due to the operation of the default subject assignment strategy. Also, the comprehension questions did not directly probe the referent of anaphors, suggesting that the subject preference is not a strategy that is adopted only when the processor is demanded to resolve anaphoric relations.

As discussed in Experiment 3, these results suggest that the default strategy of interpreting null pronouns is to link them to the subject antecedent. Taken together with

the increased reading times when a name anaphor referred to the object NP compared to when a name anaphor referred to the subject NP, there appears to be a preference to continue the subject NP in the preceding sentence in the sentence initial, subject position of the current sentence. Using the terminology of centering theory, the results can be summarized as indicating that CONTINUES (the utterances that contain in the subject position the most central element of the previous utterance), are preferred to SHIFTS (the utterances that contain in the subject position the element of the previous utterance that is not the most central one) in Korean, with the ranking of centrality/accessibility determined primarily by grammatical role (Walker et al., 1998).

Despite the robust effect of subjecthood across both the SOV and OSV orders, the prediction that reading times would elevate in the name conditions as compared to the *pro* conditions in situations where the anaphor refers to the subject antecedent was not borne out. Interestingly, Increased reading times with repeated names were observed only in the OSV order as revealed by the pattern of the interaction between word order and anaphor represented in Figure 8. This was true in both subject and object antecedent conditions.

Even though subjects are preferred referents of an anaphor in the OSV order as well as in the SOV order, it appears that the marked or atypical OSV order does mark the object as having special properties, making it identifiable. As reviewed above, scrambling in Korean is motivated by two sources depending on the context, namely givenness and prominence (Choi, 1996; Ishihara, 2000). When it is motivated by givenness, the object serves as given information and the subject gets focus reading, whereas when it is motivated by prominence, the object receives focus and the subject serves as given

information. In either case, there is a competition between the topical and focused elements. The experiment did not control for which of the two interpretations participants would get. But since both have been claimed to compete for accessibility, and it is not clear which is more accessible, a topic or a focus (Cowles, Walenski, Kluender, 2007; Kaiser, 2006), it can be argued that the atypical word order tells the comprehender something about both elements (Christianson & Cho, 2008). Thus both the subject and object are accorded special status by the OSV order, and this special status makes them both more identifiable, and both more able to be underspecified (semantically, phonologically, etc.) by using *pro*. As a result, specifying full information with repeated names seems to disrupt processing in both cases.²⁴ The observed differences in the way *pro* and names are processed cannot be explained by some of the syntactic approaches that consider null arguments as sharing the same properties of overt arguments (Kim, 1999; Saito, 2007).

The disruptive effect of repeated names was limited to the critical region, however. At the passage-final sentence that followed the critical sentence, there was an advantage of having read a name anaphor in the critical sentence. As the passage-final sentence did not mention any of the characters in the passage, this region did not involve any coreference processing. The results may indicate that the referent of *pro* is not fully integrated in the region where it appears resulting in increased reading times in the

²⁴ The critical sentence with a name anaphor was presented in the canonical order. It would be interesting to see whether there still is a repeated name penalty for the subject antecedent in the OSV order when the critical sentence is also presented in a scrambled order. It is impossible to know exactly where in the sentence the comprehender posits a null subject pronoun after the OSV order is encountered – the canonical, sentence initial position or in the preverbal position.

subsequent region whereas a name anaphor is fully processed as soon as it is encountered.

A question arises as to why reliable repeated name penalties were lacking in the SOV order. It was expected that more reduced referring expressions (i.e., null pronouns) would be more advantageous than less reduced referring expressions (i.e., repeated names) in the preferred subject antecedent condition in SOV. As shown in Figures 7 and 8, there were no reliable reading time differences related to the form of the anaphor in SOV order. The fact that the SOV order is so much more common than any scrambled orders may present some explanation: it is the default order and assumes less presupposition about the discourse representation. It hence does not highlight any of its constituents in the information structure. Apart from the tendency to continue its subject in the subject position of the subsequent utterance, it can be speculated that the SOV order presents no particular difficulty for the comprehender whether it is followed by the underspecified or fully specified anaphors. The flexibility of the canonical order mirrors the finding of Christianson and Cho (2008) in which the difficulty of eliding a less topical element instead of a more topical element surfaced only in the marked construction in Odawa.²⁵ Yang et al.'s (1999) study in Chinese in support of the repeated name penalty

²⁵ The Algonquian language Odawa has “direction” system linked to discourse status of participants. The more central NP is morphologically unmarked and termed “proximate” and the less central NP is morphologically marked and termed “obviative.” If the subject (and the thematic agent) is more central, the direct form is used, in which the verb agrees with the obviative object NP. A less frequent form called the inverse is used when the object (and the patient) is more central, in which case the verb agrees with the obviative subject NP (Christianson, 2002). In Christianson and Cho (2008), it was predicted that comprehension should be difficult when the obviative NP is realized as an overt NP and the proximate NP is elided, under the assumption that a more topical NP is more likely to be dropped. Interestingly, this prediction was borne out only in the inverse form but not in the canonical form.

compared proper names and unambiguous overt pronouns; it is not clear how inherently ambiguous pronouns are processed when directly compared with names.

Taken together, the results suggest that subjecthood plays an important role in how *pro* is interpreted and how the transition to the next utterance is determined. The effect of word order information emerged independent of the general subject preference: the OSV order seems to highlight both the scrambled object NP and the subject NP in the information structure and allows them to be easily identifiable and to be realized as *pro*, and hence processing cost ensues when full descriptions are repeated to refer to the elements that have already been granted special status.

Experiment 5

The results from Experiments 3 and 4 suggest that being a subject makes a referent more accessible to be considered as an antecedent of *pro* and to be continued as the subject of the following sentence in Korean. In contrast, the effect of word order emerged at the final interpretation stage (Experiment 3) or as a form of reading time costs for repeating the referents that have been accorded a special status by the scrambled word order (Experiment 4).

What is also noticeable in both experiments is that participants had more trouble comprehending the sentences containing potential antecedents when they were presented in the scrambled word order. In the literature, it has been pointed out that processing scrambled sentences can be more difficult due to their structural complexity and/or

infrequency (Hyönä & Hujanen, 1997; Miyamoto & Takahashi, 2002).²⁶ Kaiser and Trueswell (2004), however, point out that the observed difficulties in previous studies might have resulted from the fact that scrambled structures were presented in isolation out of discourse context. In a self-paced reading experiment in Finnish, Kaiser and Trueswell (2004) showed that the difficulty associated with atypical word orders was partially alleviated when appropriate discourse contexts were provided. In light of the finding, the reason why word order information did not as strongly guide on-line coreference processing as subjecthood in Experiments 3 and 4 may in part come from the fact that scrambled sentences were presented without felicitous discourse contexts. As a result, readers might have experienced difficulty constructing discourse representations into which scrambled sentences could be integrated felicitously, and hence the hypothesized topichood or prominence of scrambled objects might not have been signaled strongly enough.

Also as pointed out earlier, scrambling of the object NP to the sentence initial position in Korean can be motivated by two seemingly conflicting factors – moving a given/topical object NP out of the focus domain and moving a prominent/focused object NP out of the given domain (Choi, 1996; Ishihara, 2000). Topics and foci have been shown to be more accessible than other referents, but it is not clear which is more accessible when the two are directly pitted against each other (Arnold, 1999; Cowles et al., 2007; Kaiser, 2006), in part because it is difficult to control for other important factors such as whether they are defined as such at the level of sentence or discourse, and

²⁶ A study based on the analysis of a written corpus shows that the SOV order is about 10 times more frequent than the OSV order in Korean (Lim, 2007). However, scrambled word orders may occur more frequently in spoken language.

which grammatical role they take, etc. Comparing which is more accessible is beyond the scope of the current experiment, but there seems to be a need to control for which of the two readings the OSV sentences are intended for.

To address these issues, the passages similar to those used in Experiment 3 were presented embedded in supporting discourse contexts as exemplified in (7a/a'), which establish either the subject or the object of the antecedent sentence as given. Instead of fully crossing the context sentence and the antecedent sentence, the decision was made to match the SOV order with the subject-as-given context sentence and the OSV order with the object-as-given context sentence since pairing the subject-as-given context with the OSV order is not motivated in the information structure.²⁷ An appropriate base-line for the SOV order was deemed as the subject-as-given context sentence. If the word order information exerts its effect early on aided by the discourse context making the atypical order felicitous, the object antecedent condition followed by the OSV order is expected to show a processing advantage in terms reading times, and accuracy in comprehension.

7. Context sentence making the subject (a) or the object (a') in as given

- a. *Tobyeol chwukku tayhoy-ka Sanghwun-iney hakkyo-eyse yellyessta.*
state soccer league-NOM Sanghwun-GEN school-LOC was held.
- a'. *Tobyeol chwukku tayhoy-ka Yengsik-iney hakkyo-eyse yellyessta.*
state soccer league-NOM Yengsik-GEN school-LOC was held.
"The national soccer league was held at Sanghwun's/Yengsik's school."

Antecedent sentence in SOV (b) vs. OSV (b')

- b. *kyengkichwung Sanghwun-ika Yengsik-ilul kongkyekhayssta.*
game-during Sanghwun-NOM Yengsik-ACC attacked

²⁷ The prominence/focus reading of scrambling is created not by making the subject NP as given, but rather in contexts where the scrambled NP is the information that the speaker thinks is most important or the addressee is seeking most immediately (Choi, 1996). For example, the scrambled object in "*Inho-lul Swuni-ka mannassta*. Inho-ACC met Swuni-NOM" gets focus reading if the sentence follows a question like "Who did Swuni meet?"

- b'. *kyengkichwung Yengsik-ilul Sanghwun-ika kongkyekhyassta.*
game-during Yengsik-ACC Sanghwun-NOM attacked
"Sanghwun attacked Yengsik during the game."

Anaphor clause: Ambiguous *pro* vs. repeated name in continue (c) vs. shift (c')

- c. *pro/Sanghwun-ika tim-uy mitupilte-yessnunte,*
pro/Sanghwun-NOM team-GEN midfielder-was-and
"He/Sanghwun was the midfielder of the team,"
- c'. *pro/Yengsik-ika tim-uy mitupilte-yessnunte,*
pro/Yengsik-NOM team-GEN midfielder-was-and
"He/Yengsik was the midfielder of the team,"

Critical clause: Disambiguation for *pro* or transitor for names in continue (d) vs. shift (d')

- d. *Yengsik-uy kong-ul ppayssulye hayssta.*
Yengsik-GEN ball-ACC snatch-try did
"tried to snatch the ball from Yengsik"
- d'. *Sanghwun-iuy kong-ul ppayssulye hayssta.*
Sanghwun-GEN ball-ACC snatch-try did
"tried to snatch the ball from Sanghwun"

Passage-final sentence

- e. *Maywu kyengcayng-i simhassta.*
very competitive-NOM intense-was
"It was a very competitive game."

Comprehension question

- f. *Nwu-ka tim-uy mitupilteyessna?*
Who-NOM team-GEN midfielder-was-INTERR
"Who was the midfielder of the team?"
1. Sanghwun 2. Yengsik

Another goal of Experiment 5 was to examine whether referential ambiguity of null pronouns can eliminate any processing disadvantage associated with repeated names, as shown in Experiment 2 in English. Null pronouns and names were compared but this time, null pronouns were referentially ambiguous in the containing clause (7c/c'). The following clause finished the sentence and served as a disambiguation for the pronoun condition (7d/d'). It can be predicted that repeated name penalties would be mitigated or disappear given the referential ambiguity of *pro*. Finally, Experiment 5 addressed the question of at which stage of anaphor processing, the effect of referential ambiguity is revealed. In light of the findings in English from Experiment 2, and previous studies that

distinguish automatic bonding and non-automatic resolution processes (Garrod, 1994; Greene et al., 1992), it can be hypothesized that any effect of referential ambiguity would emerge in the critical clause (7d/d'), not within the clause containing the anaphors (7c/7c').

Method

Participants

The participants were fifty-two native speakers of Korean (29 females). They were paid \$7 for participating. The data from 4 participants were excluded from analyses due to more than 20% error rates on comprehension questions. The mean accuracy of the remaining 48 participants was 87.34%.

Materials and Procedure

The passage in (7) above provides an example of the stimuli. The experimental stimuli (n=48) were designed by manipulating the given status of the subject and object in SOV and OSV sentences, respectively, the grammatical role of the antecedent (subject vs. object), and the type of the anaphor (*pro* vs. name). The context sentence foregrounded either the subject or the object character in the antecedent sentence. Caution was taken, however, not to introduce the character in the sentence initial position or in either the nominative or accusative case to rule out the possibility that the experimental manipulations in the antecedent sentence (grammatical role and order of mention) interact with the way the character is presented in this region. The other character was not mentioned in the context sentence. The subject-foregrounding sentence was paired up with the SOV order and the object-foregrounding sentence was paired up with the OSV order. Either *pro* or a repeated name was introduced with a transition that

either continued the subject of the antecedent sentence or shifted to the object of the antecedent sentence. A comprehension question asked the referent of an anaphor. The experimental passages are listed in APPENDIX B.

The experimental passages were presented along with 90 filler passages that were similar in length and general format to the critical items. A comprehension question was asked after each filler passage as well as each experimental passage. Eight presentation lists were constructed by combining the 48 experimental items and 90 filler items using a Latin Square design. At the beginning of each list, there was an initial practice block consisting of 6 additional filler passages. The experiment was run in the same manner as Experiments 3 and 4.

Results

Linear mixed effects modeling was used for residual reading times at the critical clause. Reading times from other regions were also analyzed. Accuracy data were analyzed using a mixed logit model. Finally, log-transformed question response times were analyzed using mixed effects models.

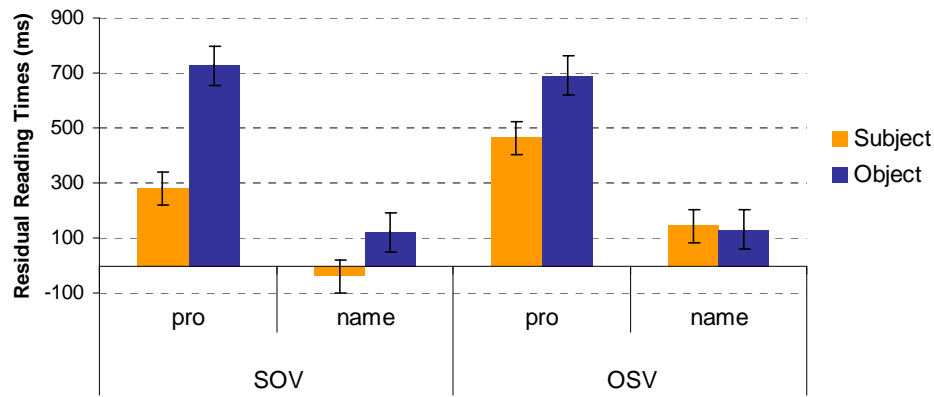
Residual Reading Times at the Critical Clause

Outliers were trimmed based on the same criteria described above, affecting 1.07% of the data. The means of residual reading times in the eight conditions (word order \times form of anaphor \times grammatical role) are plotted in Figure 9. The results of the best-fitting mixed effects model ($r^2=.35$, $\kappa=1.43$) are summarized in Table 9. There was a reliable effect of the type of the anaphor: residual reading times were faster in the name conditions than in the *pro* conditions. The main effect of the grammatical role of the

antecedent was also significant, such that reading times were faster when the anaphor had a subject antecedent.

Table 9
Linear Mixed Model Output for the Residual Reading Times at the Critical Clause (Experiment 5)

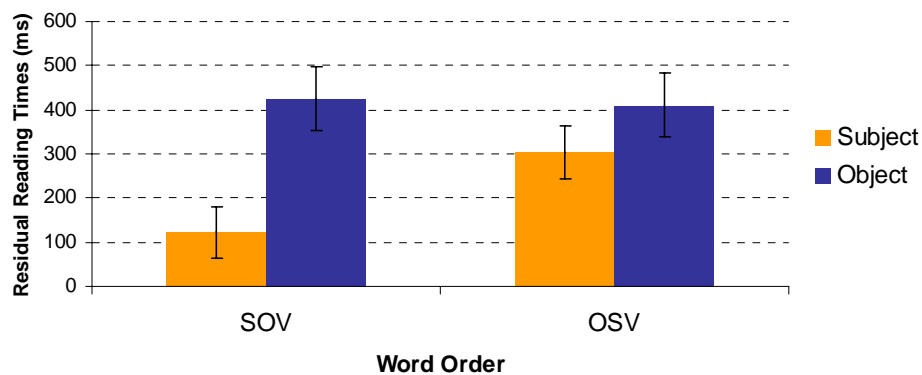
	Estimate	Std. Error	<i>t</i> value	Pr(> <i>t</i>)
(Intercept)	314.79	56.22	5.59	0.00**
Word Order (WO)	40.43	23.69	1.71	0.09
Grammatical Role (GR)	-102.75	23.71	4.33	0.00**
Form of Anaphor (ANA)	-225.15	23.72	-9.49	0.00**
WO × GR	-52.63	23.72	-2.22	0.03*
WO × ANA	4.61	23.69	0.19	0.85
GR × ANA	-69.98	23.71	-2.95	0.00**
WO × GR × ANA	0.11	23.71	0.01	0.99



(Error bars represent 95% confidence intervals)

Figure 9. Residual reading times at the critical clause (Experiment 5)

Also there was a significant interaction between the word order of the antecedent sentence and the grammatical role of the antecedent. As plotted in Figure 10, in the SOV order, reading times were faster when the antecedent of the anaphor was the subject in the antecedent sentence than when the antecedent was the object. There was no reliable difference in this respect in the OSV order.



(Error bars represent 95% confidence intervals)

Figure 10. Interaction of word order and grammatical role (Experiment 5)

Finally, the interaction between the grammatical role of the antecedent and the type of the anaphor was also reliable. With null pronouns, reading times were reliably faster in the subject antecedent condition than the object antecedent condition. The grammatical role of the antecedent did not have a reliable effect for repeated names.

Residual Reading Times at the Anaphor Clause

There were no reading time differences in this region as a function of any of the experimental manipulations.²⁸

Residual Reading Times at the Antecedent Sentence: SOV vs. OSV

Even in the presence of supporting discourse contexts, the scrambled OSV sentences were read more slowly than the canonical SOV sentences, with the mean residual reading time difference of 597.03 ms. This difference was reliable in a mixed-effects model ($t=7.81, p<.01$). The effect of trial was also significant ($t=-3.63, p<.01$).

²⁸ In Experiment 4, the critical sentence was presented as one, whereas in Experiment 5, the clause containing an anaphor was presented first followed by the second clause completing the sentence. When reading times in this clause were considered combined with the following (i.e., critical) clause, most of the observed differences in the critical region were still significant (e.g., the form of the anaphor, the grammatical role of the antecedent, and the interaction between word order and grammatical role). The interaction between grammatical role and anaphor, however, was no longer significant.

Residual Reading Times at the Passage Initial and Final Sentences

Reading times were not reliably different in these regions depending on the experimental conditions.

Question Response Accuracy

The data were fit to a mixed logit model with 2 (word order) by 2 (form of anaphor) by 2 (grammatical role) as fixed factors and subject and item as random factors. The results of the model ($D_{xy}=.46$) are summarized in Table 10. Percent correct responses for each condition are plotted in Figure 11.

Table 10

Mixed Logistic Model Output for Question Response Accuracy (Experiment 5)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	1.81	0.11	15.97	0.00**
Word Order (WO)	-0.03	0.06	-0.51	0.61
Grammatical Role (GR)	-0.05	0.06	-0.79	0.43
Type of Anaphor (ANA)	0.27	0.06	4.19	0.00**
WO × GR	0.13	0.06	2.10	0.03*
WO × ANA	-0.09	0.06	-1.35	0.18
GR × ANA	-0.02	0.06	0.25	0.80
WO × GR × ANA	0.01	0.06	0.22	0.83

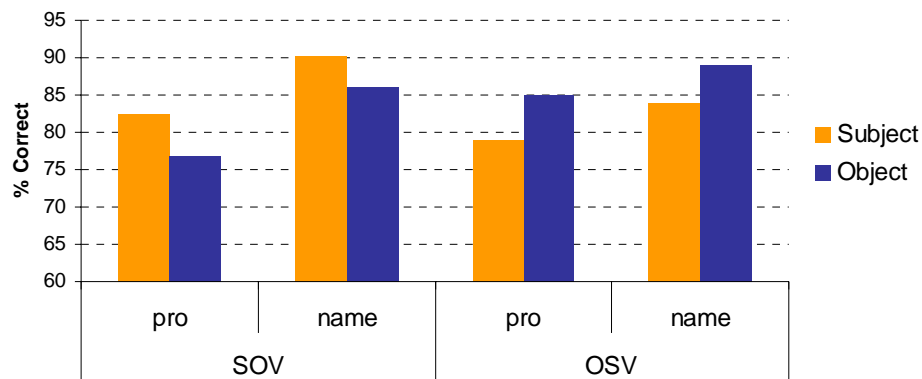


Figure 11. Question response accuracy (Experiment 5)

The model yielded a significant main effect of the form of the anaphor: comprehension was better with name anaphors than null pronouns. The interaction

between word order and grammatical role was also significant: in the SOV order, comprehension was better when the antecedent of the anaphor was the subject, and in the OSV order, comprehension was better when the antecedent of the anaphor was the object.

Question Response Times

Question response times longer than 7500 ms were replaced with the cutoff value, which affected 3.4% of the data. A mixed effects model with trial and word order \times grammatical role \times anaphor as fixed factors, and subject and item as random effects was fit to the log transformed question response times from correctly answered trials.²⁹

The model yielded a significant two-way interaction between word order and the grammatical role of the antecedent ($t=2.80, p<.01$). As plotted in Figure 12 (in raw latencies instead of log transformed latencies for ease of conceptualization), the object antecedent condition took longer to respond to than the subject antecedent condition in the OSV order, whereas no difference according to the grammatical role of the antecedent was found in the SOV order. Finally, the effect of trial was significant ($t=-7.71, p<.01$).

²⁹ In a separate model including accuracy as a fixed predictor, it was found that question answering latencies were reliably longer with incorrectly answered trials than with correctly answered trials ($t=-7.22, p<.01$). Accuracy did not participate in any reliable interactions with other predictors. The reported model was performed on the trials in which participants correctly answered comprehension questions, keeping the accuracy variable out of the model in order to try better understand the relationship between question decision times and accuracy.

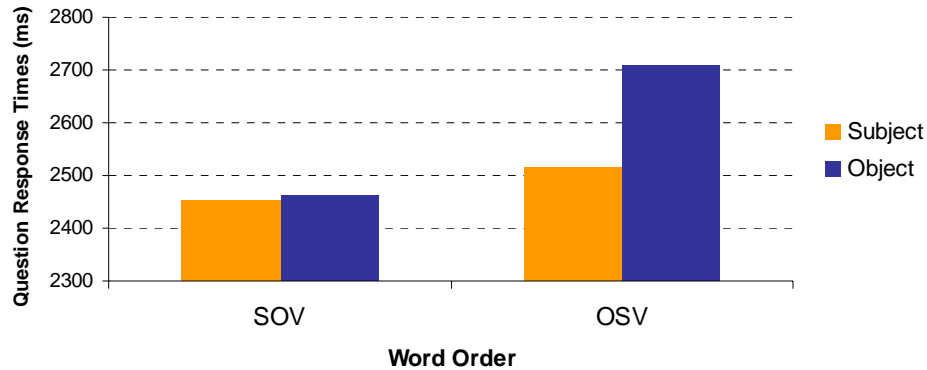


Figure 12. Question response times:
Interaction of word order and grammatical role (Experiment 5)

Discussion

One of the main goals of the current experiment was to examine whether the relatively weak and late effect of order of mention in Experiments 3 and 4 could be due to difficulty associated with the need to understand the noncanonical structure out of discourse context (Kaiser & Trueswell, 2004). To address this issue, Experiment 5 investigated whether an appropriate discourse context can facilitate the processing of scrambled structures, and in turn affect the likelihood of the scrambled objects being considered as a good antecedent of an anaphor.

The results show that reading times for the scrambled sentences were still significantly longer than the canonical sentences, suggesting that the presence of supporting discourse context does not eliminate difficulty associated with processing noncanonical sentences. In Kaiser and Trueswell's (2004) study in Finnish, the presence of discourse context only partially alleviated the usual difficulty associated with noncanonical constructions, suggesting that there seem to be inherent difficulties associated with scrambled structures resulting from, for example, low frequency and/or

syntactic complexity (Hyönä & Hujanen, 1997; Miyamoto & Takahashi, 2002).³⁰ Unlike in Experiments 3 and 4, however, the interaction between word order and grammatical role at the critical region was significant in Experiment 5, as shown in Figure 10. Collapsed across null pronouns and repeated names, the subject preference was more clearly visible in the SOV order, whereas in the OSV order, the subject antecedent condition did not seem to be reliably different from the object antecedent condition. These results suggest that when scrambled objects are strongly signaled as given/topical in the discourse, the likelihood they are considered as a good antecedent of an anaphor increases. This increased accessibility of scrambled objects, however, did not seem to eliminate the subject preference. There was a main effect of grammatical role, and in this regard Experiment 5 replicates the findings of Experiments 3 and 4 that the subject is primarily favored as the antecedent of an anaphor than the object.³¹

³⁰ In the literature on relative clause processing, researchers have observed that subject relative clauses (e.g., The lawyer that irritated the banker filed a hefty lawsuit.) are processed faster than object relative clauses (e.g., The lawyer that the banker irritated filed a hefty lawsuit.). Many explanations have been offered to explain the observed asymmetry. One of the influential accounts is that syntactic subjects map onto the reader's perspective and that processing is easier when a consistent perspective is maintained (see Traxler, Morris, & Seely, 2002, for a review). In object relative clauses, perspective shifting is required as the subject in the main clause and the subject in the relative clause are different, which is assumed to be costly. The same logic may be applied to the processing of OSV, under the assumption that both topics and subjects attract the reader's perspective.

³¹ What can also be noted is that grammatical role participated in an interaction with the form of the anaphor in Experiment 5. Therefore, one might wonder whether the subject preference is relevant only to null pronouns and not to anaphorical names (Figure 11). This finding is different from the results of Experiment 4 in which names also clearly showed the preference to continue the subject of the preceding sentence. However, the difference seems to arise as a by-product of the way materials were presented in the two experiments. In Experiment 4, the critical sentence was presented as a whole, whereas in the current experiment, the critical clause was presented after the clause containing an anaphor. As the grammatical role information was inherently available for name anaphors within the anaphor region, the processing of the critical region might not be greatly

The results of the off-line accuracy measures replicate those of Experiment 3. As indicated by the significant interaction between word order and grammatical role, participants comprehended the passages in which the anaphor referred to the object in the preceding sentence better in the OSV condition, opposite the case of the SOV condition. The interaction between word order and grammatical role was also significant in the question-answering latencies (Figure 12). In the OSV order, the conditions that yielded the longest decision times were also the conditions that were eventually answered more accurately. This relationship between longer decision times and higher accuracy in the comprehension question in the OSV order shows that extra effort spent in processing these sentences translated into better comprehension. The relationship between accuracy and decision times did not show up in the canonical order. Overall, the question decision times were reliably shorter in the SOV order than in the OSV order. It seems then that the canonical order is processed with less effort, and the higher accuracy in the subject antecedent condition within the SOV may not be a result of extra processing effort.³²

Another research question was whether any processing disadvantage associated with using repeated names anaphorically disappears as compared to null pronouns when the use of null pronouns is referentially ambiguous. Recall that in Experiment 4, significant repeated name penalties were observed in the OSV conditions for both subject and object referring names. In Experiment 5, such penalties were absent. Reading times

affected by that information. The lack of interaction between grammatical role and anaphor when the anaphor and critical clauses were combined (Footnote 26) supports this interpretation.

³² Previous studies have observed that error rates increase and correct response times slow down in situations of competitive computations (e.g., for subject-verb agreement, see Staub, 2009). The increased response times yet higher accuracy in the [OSV, anaphor=O] condition in Experiment 5 suggest that increased response times cannot be uniformly taken as an index of less accurate performance.

were significantly shorter in the name conditions than in the pronoun conditions regardless of word order. Easier processing with repeated names also translated into greater accuracy in the comprehension questions (Figure 11). The results can be understood as indicating that the correlation between the degree of reduction of referring expressions and the relative accessibility of their antecedents may be overridden by the need to unambiguously establish the link between antecedent and anaphor.

Finally, the slow-down effects due to referential ambiguity of null pronouns compared to name anaphors were not revealed until the disambiguation region; reading times were not reliably different in the clause containing these anaphors. These results provide further support for the view that readers are able to form superficial anaphoric links without investing extra processing resources. Resolution, on the other hand, may be resource-demanding (Tang & van Gompel, 2009; Vonk, 1984).

General Discussion: Experiments 3, 4 and 5

This chapter presented three experiments that investigate the influence of the grammatical role and the order of potential antecedents on the processing of anaphors in Korean. In Korean, subjecthood can be dissociated from first mention because Korean allows scrambled objects to appear sentence initially. Also, in terms of information structure, there is a good reason to believe that the accessibility of the scrambled object in the OSV order might increase, as scrambling is motivated by the givenness or prominence of the object, both of which have known to affect an entity's accessibility (Choi, 1996; Ishihara, 2000; Kaiser, 2006).

The results of the three experiments all strongly support the view that being a subject makes a referent more accessible and favored as an antecedent of an anaphor. In Experiment 3, reading times at the disambiguation region were significantly shorter when an ambiguous *pro* turned out to refer to the subject. The results of Experiment 4 showed that the subject preference was not limited to the interpretation of *pro*. Name anaphors were processed faster when they continued the subject of the previous sentence. These results provide support for the idea that continues are preferred transitions as compared to shifts or other types of transitions (Groz et al., 1995; Walker et al., 1998). The overall effects of subjecthood generalized to Experiment 5 in which the discourse function of scrambled objects as given/topical information was emphasized. As suggested by the main effect of grammatical role in Experiment 5, the processing of the critical region was facilitated when the anaphor referred to the subject.

However, the results from the three experiments suggest that subjecthood is not the only thing that matters. The effects of order of mention were observable in various aspects of the data. The first piece of evidence comes from the significant interaction between word order and grammatical role in the off-line accuracy data in Experiment 3. A closer look at the interaction pattern revealed that the condition that yielded the highest accuracy rate was when the referent of *pro* turned out to refer to the first mentioned object in the scrambled OSV order (Figure 6). Similar patterns were found in the off-line data of Experiment 5 (Figure 11), which further showed that this interaction is not limited to the case of null pronouns but generalizes to anaphoric names as well.

Secondly, the effect of word order emerged as a form of repeated name penalty in the OSV conditions in Experiment 4 (Figure 8). As discussed earlier, scrambling can be

motivated by givenness or prominence, and hence generates a competition between topical and focused elements in terms of accessibility (Choi, 1996; Ishihara, 2000). It was speculated that the OSV order promotes accessibility of the grammatical object but at the same time gives a special status to the subject in the information structure. Thus both the scrambled object and the subject are preferentially realized as *pro* rather than being repeated with a name.

Finally, Experiment 5 showed that embedding scrambled sentences in supporting discourse context can increase the accessibility of the scrambled objects. As plotted in Figure 10, the subject preference was less evident in the OSV order. Compared with the results from Experiments 3 and 4, the results of Experiment 5 can be taken as suggesting that the accessibility of the scrambled object in the OSV order can be better signalled when the specific discourse demands of the OSV order are met (Kaiser & Trueswell, 2004). It can, however, be noted that the accessibility of the scrambled object does not overwhelm the subject advantage. Subjecthood still remains as a powerful factor impacting the accessibility of a referent.

In light of the results, the reason why some of the previous studies (e.g., Kaiser, 2005; Kaiser & Trueswell, in press) failed to find the order of mention effect may in part stem from the fact that those studies did not take any off-line measures into account and/or presented noncanonical sentences out of appropriate discourse contexts, limiting the extent to which information-structural properties can play a role. In addition, the results provide evidence against the overall privileged status of first-mentioned entities as suggested by Gernsbacher and colleagues (Gernsbacher, 1990; Gernsbacher & Hargreaves, 1998; Gernsbacher et al., 1989). The surface order dissociated from

discourse function might reveal its effect in a task like probe-word recognition used in those studies, but the task has been criticized as promoting a strategy of maintaining in working memory a list of words that are likely to be probed rather than tapping into language comprehension (Gordon et al., 2000; Nicol & Swinney, 2002).

In sum, the results of the experiments reported here suggest that the strong effect of subject on referent accessibility is modulated by effects of informational structural properties associated with word order. Of course, many questions still remain open. For example, it merits further discussion why subjecthood, which guides early processing of anaphors, does not directly translate into accuracy, whereas the order of mention information plays an important role at the final interpretation stage, although it may not reveal its effect early on unless strong discourse cues are provided. A related question is what lies behind the subjecthood effect. Are subjects more privileged because of their syntactic position, or because of their semantic and/or cognitive roles? These questions will be elaborated on in the concluding chapter of the dissertation (Chapter 6).

Another main research question of the experiments was how the relationship between the accessibility of referents and the degree to which referring expressions are reduced is affected by the tendency to avoid referential ambiguity. The results of Experiment 4 showed that when the referent of a null pronoun can be easily found in the context, both repeated names and null pronouns were processed with equal ease in the SOV order. In the OSV order, reading times increased when repeated names were used as compared to when null pronouns were used, for both subject and object antecedents. On the other hand, in Experiment 5, where the use of null pronouns was not immediately disambiguated, there was an overall advantage of using names in both word orders. The

comparison of Experiments 4 and 5 suggests that although accessibility information provides a useful heuristic mechanism for interpreting referring expressions, it is not so strong as to cancel out the effect of referential indeterminacy. In other words, the repeated name penalty, or the difficulty in comprehension caused by the overspecificity of the repeated use of a name instead of a pronoun (Gordon et al., 1993), can be eliminated by referential ambiguity.

CHAPTER 5

COREFERENCE PROCESSING IN ENGLISH AS A SECOND LANGUAGE

This chapter reports two self-paced reading experiments that investigated the processing of coreference by second language learners. L1 Korean speakers of English as a second language read the passages that were identical to those used in Experiments 1 and 2, and their processing strategies and performance were compared with those of native English speakers.

Processing and production of referring expressions in the L2 have been shown to pose persistent difficulties because of the difficulty associated with coordinating and integrating syntactic and discourse-pragmatic information, which is referred to as the Interface Hypothesis (Sorace, 2004; Sorace & Filiaci, 2006). However, there continues to be debate as to the cause of the non-convergence (Hopp, 2007; Sorace, 2008, 2009). This study explores the nature of difficulties focusing on L1 effects and processing resource limitations. Before describing the details of the experiments, the next section briefly reviews the Interface Hypothesis and the debate on the nature of difficulties at the interface.

The Interface Hypothesis

According to the Interface Hypothesis, interface properties at syntax and other cognitive systems in the L2 may not be fully acquirable (Platzack, 2001; Sorace & Filiaci, 2006). The appropriate use of referring expressions may present one such domain because it requires the coordination and integration of correct syntactic conditions and discourse-pragmatic information underlying their distribution. In support of the Interface

Hypothesis, research on different bilingual populations, all claimed to be ‘very advanced’ and ‘near-native,’ has shown that interpretation and use of coreference relations are characterized by protracted difficulty and instability (Montrul, 2004, for Spanish heritage speakers of L2 English; Serratrice et al., 2004, for Italian-English early bilinguals; Sorace & Filiaci, 2006, for adult L1 English learners of L2 Italian; Tsimpli et al., 2004, for Italian heritage speakers of L2 English). More specifically, these studies focused on the L2 acquisition of null vs. overt pronouns in null subject languages like Spanish and Italian, and showed that the bilingual populations are more likely than native monolingual speakers to extend overt subject pronouns to contexts that require the use of a null subject, both in comprehension and production. In these studies, cross-linguistic influence from a non-null subject language (i.e., English) was argued to be responsible for the observed patterns, because, in English, the use of overt subject pronoun is obligatory and there is no division of labor between null and overt pronouns (Carminati, 2002).

However, there is emerging evidence showing that the difficulties in the domain of subject pronouns are attested not only in bilingual speakers of two languages that are typologically different, as in the aforementioned studies, but also in bilinguals of two similar languages whose L1 distinguishes overt and null pronouns (Margaza & Bel, 2006, for L1 Greek-L2 Spanish bilinguals). This observation suggests that a transfer effect may not be the only explanation for the observed patterns. It is conceivable that overt pronouns may be a default form employed to compensate for processing overload imposed by null pronouns (Sorace, 2008; Sorace and Filiaci, 2006). The more reduced a

referring expression is, the less amount of information can be directly retrieved from it, which may give rise to processing cost for L2 populations.

In addition to different distributional properties of overt and null pronouns, when we extend the scope to general reference maintenance strategies in the L2, there have been observations that L2 learners tend to be more explicit in reference maintenance than native speakers of the target language (Hendricks, 2003; Kang, 2004, 2009). Kang's (2004, 2009) study on oral and written narratives produced by Korean learners of L2 English, for example, showed that Korean speakers had a tendency to rely on explicit reference without using pronouns as frequently as native speakers of English did. She speculates that the results might reflect transfer effects from L1 reference maintenance strategies because Korean speakers frequently rely on explicit referring expressions in L1 Korean. Hendricks (2003), on the other hand, suggests that over-explicitness in L2 acquisition is a general inter-language phenomenon that L2 learners opt for irrespective of source-target language pairs.

These studies converge on showing that there are persistent difficulties at syntax-discourse interfaces such as the referential system in the L2, but do not yet allow for definitive conclusions about the cause of these difficulties. Specifically, the hypothesis that cross-linguistic influence may be at the root of difficulties with less explicit reference does not seem inclusive enough to explain all the data. By definition, the difficulties at the interface might arise from increased processing demands required to coordinate and integrate multiple levels of knowledge. On this view, the difficulties are understood to lie at the processing level, and L2 learners may prefer explicit reference as a general relief strategy.

These processing difficulties may arise in any language, not just in languages that have been viewed as having a relatively complex reference system. In any language, when a reader encounters reduced anaphors such as pronouns in discourse, she has to determine the set of potential antecedents, and select the appropriate referent from this set, based on multiple sources of information, such as the relative accessibility of the discourse entities (Nicol & Swinney, 2002). This process, at least at the initial stage of determining the candidate set, has been known to be quite autonomous for native speakers (Garrod, 1994; Greene et al., 1992). On the other hand, L2 learners may find it difficult to coordinate these sources information, even when there are no L1 options interfering with appropriate use of L2 forms. To better understand cross-linguistic and processing factors, it would be worth investigating whether difficulties at interfaces still arise even in the absence of any potential cross-linguistic interference.

Another issue that merits further discussion is how to define the ‘endstate’ grammar. The previous studies in support of the Interface Hypothesis claim that their participants show non-convergence despite their near-native level of proficiency in L2 (cf. L1 attrition in heritage speakers). The criteria for L2 near-nativeness, however, are difficult to establish. It might be more informative to consider proficiency as a variable factor among L2 populations and probe how proficiency is related with processing strategies. It seems worth pursuing whether L2 learners can free more processing resources to better integrate interface conditions with increasing proficiency.

To address these issues, Experiments 6 and 7 compare coreference processing by L2 learners at different proficiency levels and native speakers in situations where the processing strategies normally employed in L1 and L2 are similar.

Experiment 6

In Experiment 1, it was shown that native English readers prefer to interpret a temporarily ambiguous pronoun to refer to the subject of the previous sentence in a passage like (1), which is repeated below. Also being more accessible than the object, it was shown that the subject entity serves as a good antecedent of reduced referring expressions like a pronoun: reading times were not different in the pronoun and name conditions for the subject antecedent. On the other hand, for object antecedents, significant slow-down was observed when a pronoun was used as compared to when a repeated name was used.

1.
 - a. The computer seemed to have caught a virus.
 - b. Ben called Matt for help.
 - c. *He/Ben* asked Matt to take a look at the computer.
 - c'. *He/Matt* asked Ben what the problem was.
 - d. A lot of important data seemed to be missing.

In Experiment 4 in Korean, the results for the canonical word order (SOV) were similar to the findings of Experiment 1. Reading times significantly increased when an anaphor turned out to refer to the object antecedent. Also, a null pronoun anaphor tended to be processed as fast as a name in the subject antecedent condition. In the object condition, a null pronoun was read slightly slower than a name, but this difference was not statistically reliable.

The comparison of English and Korean data suggests that more or less universal principles underlie the interaction between linguistic means used to refer and the accessibility of the entity referred to in both languages, at least in these structures used in these comparable materials (Ariel, 1990; Groz et al., 1995; Gundel et al., 1993), although the number of referring expressions and the means of ranking accessibility may differ

(e.g., word order in Korean). According to the view that instability at the interface is due to cross-linguistic influence, the use of a pronoun in passages like (1) will not pose any difficulty for L1 Korean speakers, at least in the subject antecedent condition. If, on the other hand, processing overload limits the extent to which the syntax-discourse interface conditions can be integrated independent of L1, there will be a preference for explicit reference even when the pronoun refers to an accessible entity. Under this view, the difficulty will be more pronounced among L2 speakers with lower proficiency because their processing resources are predicted to be more limited than those of higher proficiency L2 speakers.

To summarize, this study aims to probe possible causes of difficulty at interfaces and the role of L2 proficiency in the learning of L2 interface conditions. Furthermore, unlike the previous studies that have focused on overt vs. null pronouns, this study explores the Interface Hypothesis with the processing of pronouns and names in English, which has been believed to be very simple and have not been paid much attention.

Method

Participants

The participants were forty Korean-English bilinguals (18 females) recruited from the University of Illinois at Urbana-Champaign community. The participants in Experiment 6 also participated in Experiment 7 and were paid \$10. All were unbalanced bilinguals who spoke Korean as their native language and English as their second language. They started learning English in Korea in a formal education setting after the native language was fully acquired. The scores from a cloze test administered as a

measure of English proficiency prior to the experiment revealed that the participants were fairly fluent in English ($M=.81$, $SD=.08$).

Data from four participants who had lower than 65% accuracy on comprehension questions were eliminated, leaving 36 participants. For Experiments 1 and 2, which investigated processing in participants' native language, the cutoff point was 80%. The overall comprehension accuracy in Experiments 6 and 7 was a lot lower, which was understood to be due to general difficulty associated with processing a second language rather than lack of attention. So the cutoff point was set arbitrarily at 65%, and the mean accuracy of the remaining participants was 80%. Detailed demographic information about the 36 participants in Experiments 6 and 7 is presented in Table 11.

Table 11
Demographic Information on Participants (Experiments 6 & 7)

	Mean	Range
Age	27.7	20 ~ 40
Age of arrival in U.S.	24.1	12 ~ 36
Years living in English-speaking countries	3.5	1 ~ 15
Years of formal education in English	9.4	3 ~ 18
Daily English usage (%)	36.8	10 ~ 80
Self-rated proficiency (1 ~ 10)		
reading	7.4	3 ~ 10
writing	6.5	2 ~ 9
speaking	6.6	3 ~ 10
listening	7.2	3 ~ 10

Materials

The materials used in Experiment 6 were identical to those used in Experiment 1 (APPENDIX A). The four versions of a sample item are repeated in (1) above.

Procedure

The self-paced task proceeded in the same way as in Experiment 1. After the self-paced reading task was completed, the participants were asked to take a cloze test to

measure their level of English proficiency. The cloze test consisted of a story with forty blank spaces, each of which was followed by three choices. The participants were asked to select the most appropriate word among the given choices. The participants then filled out a language background questionnaire that asked for detailed information on their age, age of arrival in the United States, years of formal instruction in English, and self-rated English proficiency. The cloze test and the language background questionnaire can be found in APPENDIX C.³³ The entire session took approximately 60 minutes.

Results

Residual Reading Times at the Critical Sentence

Outliers were trimmed based on the same criteria described for Experiment 1 except that the upper cutoff value was set at 7500 ms instead of 5000 ms based on the visual examination of the distribution of the data points.³⁴ This affected 3.7% of the data. The data were analyzed basically in the same manner as the data in Experiment 1. However, to address the issue of how L2 proficiency affects L2 processing, participants were divided into two groups on the basis of the mean of cloze scores as the cutoff value: High-proficiency ($N=20$, $M=86.3$, $SD=6.5$) and Low-proficiency ($N=16$, $M=74.5$, $SD=3.9$). This proficiency variable was included as a fixed effect along with the experimental variables (form of anaphor: pronoun or name; grammatical role of antecedent: subject or object).

³³ The English Cloze test and language history questionnaire were adapted from the ones used by Paola Dussias at Pennsylvania State University. The original version of the cloze test did not list choices for the missing words but I used a multiple-choice version adapted by Silvina Montrul and Tania Ionin at University of Illinois at Urbana-Champaign to reduce load on participants and for reliability of scoring.

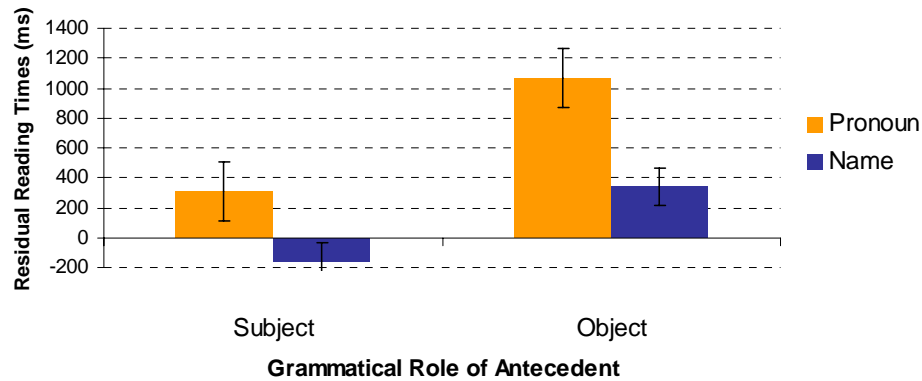
³⁴ This was because L2 processing is generally slower than L1 processing. The mean reading time was 3267.6 ms ($SD=2010.2$) in Experiment 6, whereas the mean reading time was 1895.7 ms ($SD=1004.6$) in Experiment 1 at this region.

Other participants-internal variables such as age of arrival, years living in English-speaking countries, and self-rated proficiency were also considered in the model selection procedure. Only main effects were examined for these variables, however, because they are not categorical variables that can be combined with the experimental variables to give rise to fully-crossed conditions to be compared. These variables did not significantly contribute to the model fitting, and hence they were not included in the reported model.

The best-fitting model ($r^2=.12$, $\kappa=1.44$) is summarized in Table 12. The main effect of the grammatical role of the antecedent was significant: the object antecedent condition gave rise to longer reading times than the subject antecedent condition. The effect of the form of the anaphor was also significant: reading times were reliably faster when a name anaphor was used. Of interest is the fact that the advantage of a name anaphor was found regardless of the grammatical role of the antecedent, as represented in Figure 13. The model also revealed an effect of trial suggesting that participants sped up as they progressed through the experiment.

Table 12
Linear Mixed Model Output for the Residual Reading Times at the Critical Sentence (Experiment 6)

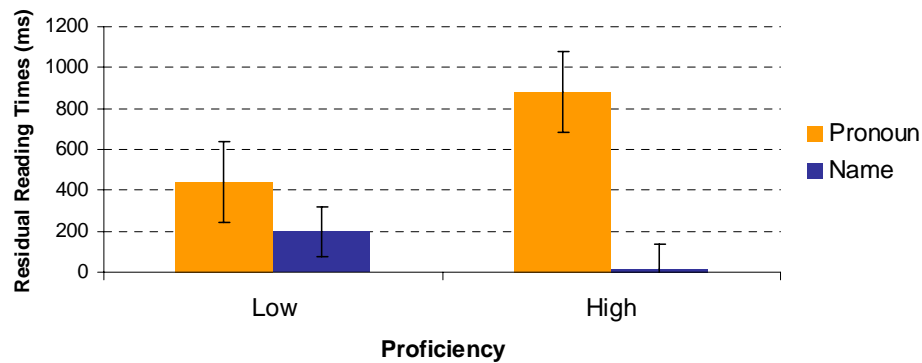
	Estimate	Std. Error	<i>t</i> value	Pr(> <i>t</i>)
(Intercept)	740.48	125.96	5.88	0.00**
Trial	-5.11	1.46	-3.50	0.00**
Proficiency (PROF)	58.60	55.77	1.05	0.29
Grammatical Role of Antecedent (GR)	296.34	55.90	5.30	0.00**
Type of Anaphor (ANA)	-262.66	55.93	-4.70	0.00**
PROF × GR	81.66	56.01	1.46	0.15
PROF × ANA	-148.96	56.20	-2.65	0.01*
GR × ANA	70.82	55.92	-1.27	0.21
PROF × GR × ANA	-34.07	56.14	-0.61	0.54



(Error bars represent 95% confidence intervals)

Figure 13. Residual reading times at the critical sentence (Experiment 6)

Finally, there was a significant interaction between anaphor type and proficiency. As represented in Figure 14, the difference between the name and pronoun conditions was greater in the high proficiency group.

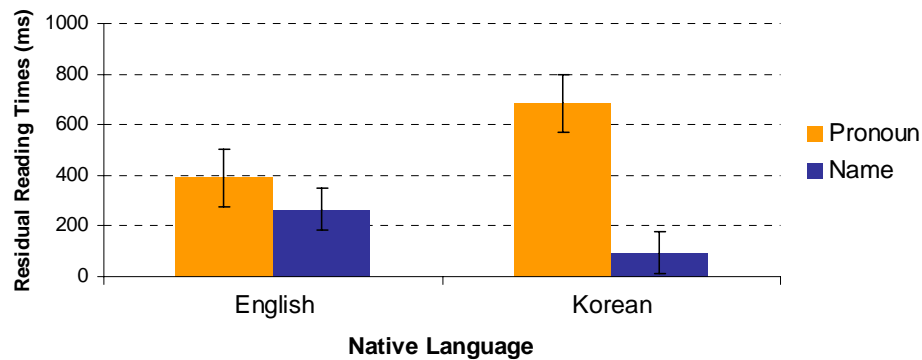


(Error bars represent 95% confidence intervals)

Figure 14. Interaction between L2 proficiency and anaphor (Experiment 6)

To address whether L2 processing differs from the processing by native speakers, an L2 model without proficiency and other participants-internal variables was compared with the model built for Experiment 1 with native English speakers including the native language (Korean vs. English) as a fixed-effect. As plotted in Figure 15, there was an interaction between native language and the type of the anaphor ($t=-3.70, p<.01$): the L2

group found pronouns more difficult to process than name anaphors to a larger extent than the native English speakers.³⁵



(Error bars represent 95% confidence intervals)

Figure 15. Interaction between native language and anaphor (Experiment 6)

The residual reading times before or after the critical region did not vary significantly according to proficiency, the grammatical role of the antecedent, or the type of the anaphor.

Discussion

In light of the Interface Hypothesis, this study investigated whether the processing of subject anaphors (pronouns vs. repeated names) by L2 learners of English was different from that of native English speakers. Specifically, the study addressed the question of whether relying on explicit reference is a default adopted by L2 learners due to the limitations of available processing resources even when there are no potentially conflicting L1 options.

³⁵ In the combined model, the main effects of the grammatical role of the antecedent ($t=8.44, p<.01$), the form of the anaphor ($t=-5.49, p<.01$), and trial ($t=-5.11, p<.01$) were also significant along with the interaction between the grammatical role of the antecedent and the type of the anaphor ($t=-2.28, p<.05$). These effects, however, will not be further discussed since what is of interest here is to see whether there were any between-group differences.

The results revealed a general processing benefit of repeated name anaphors. The advantage was not limited to the object antecedent condition. Even in the subject antecedent condition, the L2 learners found it easier to have repeated name anaphors instead of pronouns (Figure 13). As pointed out earlier, no such processing difference between pronouns and names in the subject antecedent condition was observable in native speakers. On the contrary, studies have suggested that there is a cost associated with using a repeated name coreferentially for the grammatical subject of a sentence in a locally coherent discourse for native speakers (Gordon et al., 1993; Gordon & Scarse, 1995). Even though no such repeated name penalty was present in the native speakers considered as the control group in this study, the native speakers treated pronouns as a good anaphoric device to refer to the subject antecedent. The direct comparison between the native speakers and the L2 learners confirms the difference between the two groups, with the L2 group favoring explicit reference (Figure 15).

As mentioned earlier, this cannot be attributed to L1 influence since the expectation that a reduced form would be a good referring expression for a highly accessible entity tends to hold true universally, including Korean, as shown in the experiment involving Korean passages (Experiment 4). These results can be taken to provide support for the view that the demands of the syntax-discourse mapping involved in the interpretation of pronouns may strain or exceed the processing capacities of L2 learners (Hopp, 2007; Sorace, 2008). Pronoun interpretation in English is assumed to be relatively less complex as compared to languages in which overt pronouns and null pronouns show different distributional properties, and there is no doubt that L2 learners had considerable experience with English pronouns. Yet the observed non-convergence

suggests that interpreting a pronoun in discourse in any language requires the assessment and integration of necessary syntactic and discourse conditions, which may involve a more complex process for L2 learners than previously assumed (Roberts et al., 2008).

When a pronoun is read, it has been assumed that the candidate antecedents that match the pronoun with respect to agreement features are automatically reactivated. When there is more than one candidate, information from real-world knowledge and discourse accessibility may be invoked to eliminate the competitors (Nicol & Swinney, 1989). It might be the case that L2 learners are more confused by having more than one gender/number matching antecedent. Also it can be speculated that the reactivation of potential antecedents in L2 processing is not as automatic or as detailed compared to L1 processing. Repeated name anaphors do not require any morphological filter, and their interpretation does not depend on the reactivation of a detailed semantic representation of the antecedent, and hence, is relatively easier.

The prediction that L2 learners will be able to free more processing resources at the interface as their proficiency increases, however, was not supported. On the contrary, as summarized in Figure 14, the advantage of having repeated name anaphors was greater for more proficient L2 learners than in less proficient L2 learners. It does not seem likely that the low proficiency group, but not the high proficiency group, patterned like native speakers. It seems that the high proficiency group was better able to take advantage of the explicit cue of coreference in building a coherent representation of the whole passage, whereas the low proficiency group did not benefit as much from the same cue. The participants in this study were recruited from the graduate and undergraduate population who were living in the US, and all of them reported English as their most highly

proficient L2. However, as L2 learners who started learning English in an immersion setting after puberty, their proficiency might not have reached the criteria of being ‘near-native’ (White & Genesee, 1996). It would be interesting to see whether even more proficient adult L2 learners will eventually converge on the processing strategies adopted by native speakers.

In other respects, the L2 learners looked very similar to English native speakers. As in their L1, the L2 learners had harder time interpreting an anaphor when it referred to the object entity in the previous sentence than when it referred to the subject entity. This was true for both pronoun and repeated name anaphors. Given that the subject preference is more or less universal, it would seem that learners can easily come to the conclusion that discourse organization in their L2 is governed by the same principle.

The results of the study show that resolving pronouns in an L2 might impose greater processing demands on L2 learners than previously assumed, even at high levels of proficiency. English subject pronouns are assumed to be simple, and there is no doubt that the L2 learners in this study have acquired the necessary grammatical representations for the English pronominal system. In this regard, the difficulties do not seem to arise from deviance at the representation level. The results provide support for the Interface Hypothesis that the real-time integration of information across syntax and discourse-pragmatic modules may require L2 learners to invest extra processing resources. The results also shed new light on the Interface Hypothesis. To the extent that processing resource limitations can explain the attested L2 learners’ reliance on explicit reference, the role of cross-linguistic influence may need reassessment. Also, the interface

instability may be relevant to a wider range of referential terms, including apparently simple ones.

Experiment 7

Provided the difficulties with pronominal reference lie at the processing level, and explicit reference is a general relief strategy adopted by L2 learners, it is predicted that even native speakers may resort to this default in a situation of processing overload (Hopp, 2007; Sorace, 2008). Recent studies on anaphor processing in native speakers suggest that the referential link between anaphor and antecedent may remain underspecified in certain situations (Stewart et al., 2007). Referential ambiguity of an anaphor can be thought to present one such situation.

Recall that in Experiment 2, the referential ambiguity of a pronoun had a more global effect on the discourse. As the example (2) repeated below shows, the ambiguous region was longer and the proper interpretation of the pronoun required faithful bottom-up processing rather than top-down sources of information such as real-world knowledge. Under this situation, the preference for repeated names also surfaced for native speakers in terms of both reading time and question-answering performance: independent of whether the anaphor referred to the subject or object entity, reading times were shorter in (2d) when this region followed a repeated name in (2c), and the accuracy in answering comprehension questions like (2f) was also higher.

2.
 - a. It was time for lunch.
 - b. Susan visited Emily briefly.
 - c. She/Susan bought two coffees // d. and handed one to Emily.
 - c'. She/Emily bought two coffees // d'. and handed one to Susan.
 - e. The coffee shop was crowded with office workers.
 - f. Who bought two coffees? 1. Emily 2. Susan

These results suggest that native speakers also need to invest extra processing resources to resolve an ambiguous pronoun when its referent is not readily disambiguated. Also, the final interpretation may not be as stable as when an unambiguous anaphor was used, even though its ambiguity was only temporary.

Interestingly, in Experiment 2 with native speakers, the effect of referential ambiguity on reading times did not show up in region (2c/2c'). According to the two-stage model of anaphor processing, the initial stage of determining the antecedent candidate set is an automatic process which does not take much processing resources (Garrod, 1994; Garrod & Sanford, 1994). Under this view, the reading time increase in region (2d/2d') can be understood as reflecting the difficulty at the resolution stage, during which the activation of the competitors is suppressed. Given that it is uncommon in natural languages that pronouns are sometimes formally ambiguous until more materials are provided, it can be speculated that the processor is flexible to this type of underspecified representation and also is capable of parallel processing of alternative interpretations in anticipation to disambiguating information (Kamide, 2008; Nieuwland & Van Berkum, 2008). In short, the reading time patterns in the native speakers can be characterized by a fast and automatic generation of alternative interpretations and an anticipation-based processing.

Using the same materials as used in Experiment 2, Experiment 7 investigates the locus of the observed difficulties of pronominal reference in L2 learners. If reactivating potential referents of an anaphor comes with measurable processing cost in L2 processing, and/or if L2 processing is less parallel and less anticipatory, the effect of referential ambiguity is expected to surface earlier compared to the processing in native

speakers. Another possibility is that, to the extent that the initial stage of anaphor processing is automatic, the effect of referential ambiguity will not show up until the processor is required to commit to one particular interpretation, i.e., in the reading of (2d/2d'). In either case, in light of the finding in Experiment 6 showing the high proficiency group's greater benefit in the name condition, referential ambiguity should have greater impact in the high proficiency group.

The effect of the relative accessibility of antecedents is predicted to show up as a form of a reading time advantage in the subject antecedent condition. Specifically, the comparison between the subject and object antecedent conditions in the disambiguating region will provide information on the nature of processing in the ambiguous region. The performance from the comprehension questions is expected to provide information on how stable the final interpretation is according to referential ambiguity and accessibility factors.

Method

Participants

The participants in Experiment 6 also participated in Experiment 7 because the materials for both experiments were interleaved in the lists.

Materials, Design, and Procedure

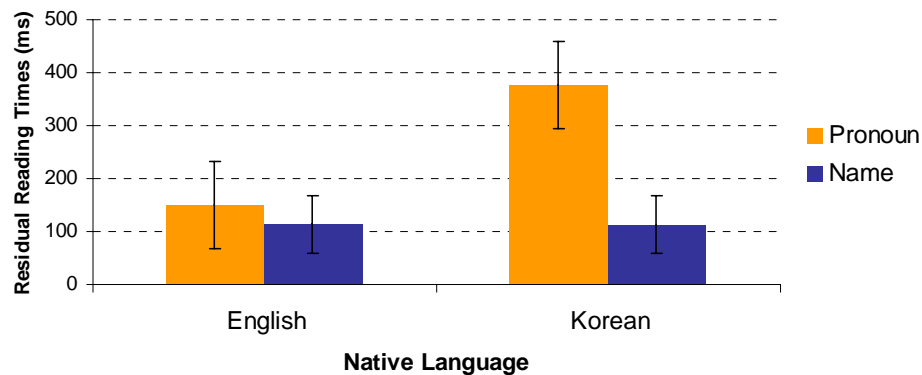
The materials were identical to those used in Experiment 2 (APPENDIX A). Experiment 7 followed the same procedure as Experiment 6.

Results

Reading Times at the Critical Sentence

The critical sentence was presented in two parts: the first clause containing the anaphor (pronoun or name) and the second clause completing the first clause, which served as disambiguation for the pronoun condition. Trimming of outliers was based on the same criteria as in Experiment 6, and this affected 2.9% and 4.0% of the data from the first and second clause, respectively.

In the first clause, the name condition was read significantly faster than the pronoun condition ($t=-3.17, p<.01$). The effects of grammatical role of the antecedent or the proficiency of the participants were not significant in the model. When the data from the Korean speakers were compared with those from the native English speakers, it was revealed that the processing advantage in the name condition was present only in the L2 group, as revealed by a significant interaction between native language and the anaphor type ($t=-2.82, p<.05$). This interaction is plotted in Figure 16.



(Error bars represent 95% confidence intervals)

Figure 16. Interaction between native language and anaphor (Experiment 7)

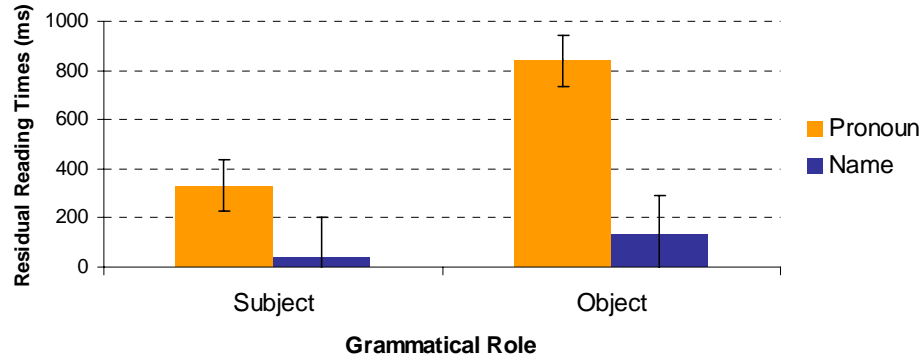
In the second clause, the best-fitting model ($r^2=.23, \kappa=1.42$) revealed a significant effect of the grammatical role of the antecedent such that residual reading times were

shorter in the subject antecedent condition than in the object antecedent condition. The type of the anaphor was also significant: reading times were significantly shorter when the critical sentence contained a name anaphor than when it contained a pronoun. These results are summarized in Table 13 and Figure 17. Although the reading time advantage in the name condition was bigger in the high proficiency group than in the low proficiency group (605.3 ms vs. 395.41 ms in residual reading times), this difference only approached significance ($p=.07$). A separate modeling including the native language as one of the fixed factors did not reveal any differences between the native English and native Korean speakers within this region.

In the passage-final sentence, none of the effects were significant. Reading times in the first two sentences that provided the general context for the passage and that introduced the potential antecedents for the anaphors did not vary significantly according to the experimental manipulations.

Table 13
Linear Mixed Model Output for the Residual Reading Times at the 2nd Half of the Critical Sentence (Experiment 7)

	Estimate	Std. Error	<i>t</i> value	Pr(> <i>t</i>)
(Intercept)	304.06	115.52	2.63	0.00**
Proficiency (PROF)	56.76	45.82	1.24	0.32
Grammatical Role of Antecedent (GR)	150.37	43.49	3.46	0.00**
Form of Anaphor (ANA)	-241.21	43.54	-5.54	0.00**
PROF × GR	20.12	43.97	0.46	0.65
PROF × ANA	-79.36	44.06	-1.80	0.07
GR × ANA	-79.60	43.54	-1.83	0.07
PROF × GR × ANA	40.50	44.05	0.92	0.36



(Error bars represent 95% confidence intervals)

Figure 17. Residual reading times at the 2nd half of the critical sentence (Experiment 7)

Question Response Accuracy

The results from a mixed logit model ($D_{xy}=.49$) are summarized in Table 14 and Figure 18. The effect of the grammatical role of the antecedent was significant: comprehension questions were answered more accurately when the anaphor had a subject antecedent. Also, accuracy was greater in the name condition than in the pronoun condition. None of the interactions were significant. Finally, the high proficiency group had a higher accuracy than the low proficiency group.

Table 14

Mixed Logistic Model Output for Question Response Accuracy (Experiment 7)

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	1.20	0.13	9.30	0.00**
Proficiency (PROF)	0.30	0.13	2.27	0.02*
Grammatical Role of Antecedent (GR)	-0.22	0.08	-2.58	0.01*
Form of Anaphor (ANA)	0.35	0.08	4.09	0.00**
PROF × GR	-0.08	0.09	-0.90	0.37
PROF × ANA	-0.06	0.09	-0.65	0.51
GR × ANA	0.06	0.08	0.66	0.51
PROF × GR × ANA	0.06	0.09	0.70	0.48

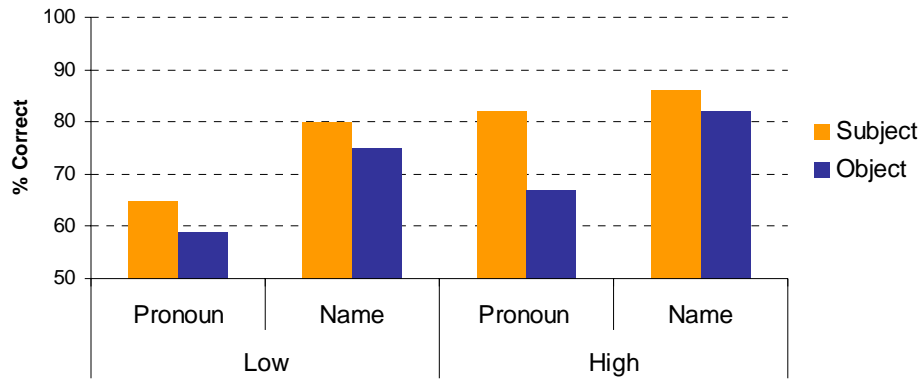


Figure 18. Question response accuracy (Experiment 7)

In the group comparison between the native Korean speakers and the native English speakers, it was revealed that the accuracy of the native Korean speakers was significantly lower than the native English speakers ($z=-3.93, p<.01$). Native language did not interact with any of the other variables.

Question Response Times

Question response times were log-transformed after removing response times longer than 10000 ms, which affected 1.5% of the data. It was revealed that question were answered more quickly when the passage contained a name anaphor ($t=-3.55, p<.01$). The effect of proficiency was also significant: the high proficiency group had reliably shorter question response times than the low proficiency group ($t=-2.20, p<.05$). Finally, the question response times tended to get shorter as the trial number increased ($t=-3.53, p<.01$).

In the group comparison, there was a significant effect of native language such that the question response times were significantly longer for the native Korean speakers than for the native English speakers ($t=6.38, p<.01$). The interaction between native language and anaphor was also significant ($t=-2.37, p<.05$): question response times were

reliably longer in the pronoun condition than the name condition, only in the L2 group. These results are summarized graphically in Figure 19 in raw question response times.

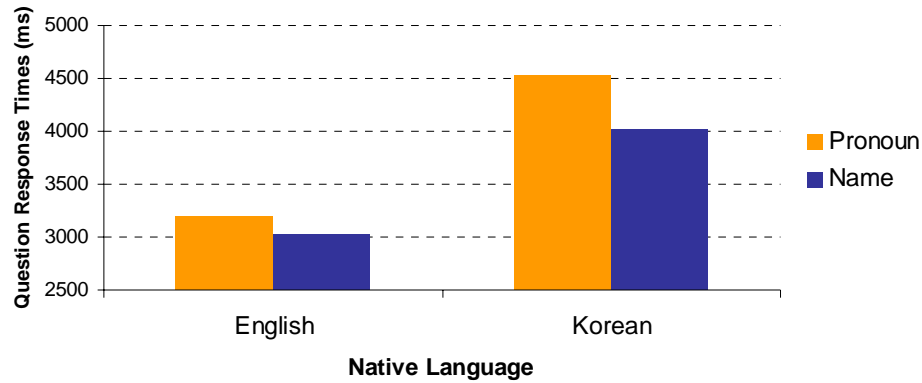


Figure 19. Question response times (Experiment 7)

Discussion

Experiment 7 was designed to determine the locus of difficulties associated with pronominal reference in L2 processing. According to the two-stage model of anaphor processing, the initial stage, loosely associated with defining the candidate antecedents set, may proceed automatically, whereas the second stage of committing to one interpretation requires more strategic processing (Garrod, 1994; Greene et al., 1992). In contrast with the native control, the L2 learners slowed down in the region where the ambiguous pronoun was first encountered (Figure 16). The results suggest that a pronoun does not automatically reactivate potential referents in L2 processing, or that holding unresolved choices in memory exceeds the capacity of the processing resources. Native speakers, on the other hand, seem better able to form loose superficial links between a pronoun and possible antecedents (with different weight on the basis of the relative accessibility), and keep them in the processing buffer in anticipation of later disambiguation. The diverging patterns in the initial stage of anaphor processing provide

support for the view that L2 processing is less automatic and less parallel than L1 processing (Clahsen & Felser, 2006).

The difficulty with referential ambiguity of pronouns persisted in the disambiguation region. Reading times in this region elevated when it followed a pronoun as compared to a repeated name. In both L1 and L2 processing, suppressing the activation of competitors and making a referential commitment seem to require strategic and effortful processing (Greene et al., 1992). Stewart et al. (2007) argue that there may be no processing difficulty associated with reading sentences containing ambiguous pronouns under shallow processing. Considering that the comprehension questions required resolution to take place in the present study, it seems that the participants were encouraged to engage in deep processing and invest processing resources to interpret the ambiguous pronouns.

As in Experiment 6, the preference for explicit reference was more pronounced in the high proficiency group, although this was not significant at .05 alpha level ($p=.07$). The results may suggest that it is the high proficiency group which can skillfully take advantage of available cues for anaphoric links. With respect to the grammatical role of the antecedent, the L2 learners were not different from the native speakers: both groups found it a lot easier to have subject antecedents than object antecedents. This was true for both types of anaphors, but the disruption with an object antecedent tended to be greater with a pronoun ($p=.07$). The fact that it was more difficult to recover from disambiguation towards the object than it was to disambiguate towards the subject in the pronoun condition suggests that the referential candidates are weighted differently during the initial stage of processing.

The name advantage and subject advantage in reading times were mirrored in off-line question-answering performance as shown by greater accuracy in these conditions (Figure 18). The high proficiency group performed better than the low proficiency group, but it can also be noted that both groups similarly benefited from a name anaphor and a subject antecedent.

Finally, the observed reading time differences across conditions in the disambiguation region did not show up in the passage-final sentence for L2 speakers. In native speakers, the difficulty with a pronoun, especially with an object antecedent, carried over into this region, which can be interpreted as suggesting the difficulty of building a coherent representation of the discourse as a whole in this condition (See Table 3 & Figure 3 in Chapter 3). This group difference suggests that the processing in one's native language proceeds in a fast and integrative way. In an attempt to relate sentences and update the current discourse model, it seems uncommon for native speakers to leave one region before it is fully specified. This effect might have arisen as a by-product of a self-paced reading task, because one cannot preview the following regions. On the other hand, the nonnative speakers seem to rely more on the strategy of processing one region at a time. As also shown in the earlier effect of referential ambiguity in the L2 learners, holding underspecified information in the processing buffer to take into account subsequent words may exceed their processing capacity.

General Discussion: Experiments 6 and 7

Two experiments probed the locus of difficulties at the syntax-discourse interface in L2 within the domain of coreference processing. Specifically, Experiment 6 sought to

establish whether adult Korean speakers of L2 English adopt the target-like strategies in the processing of English anaphors. As both their L1 and L2 coreference processing patterns can be explained by the accessibility considerations which are generally assumed to hold universally, any processing differences could not be attributed to cross-linguistic interference. The account based on the limited processing resources in L2 on-line processing, on the other hand, would predict reliance on explicit reference as a relief strategy in the absence of cross-linguistic influence.

Both experiments clearly revealed the L2 learners' preference for explicit reference. In Experiment 6, pronouns were formally ambiguous but the context clearly disambiguated them towards one interpretation, but still L2 learners preferred reading unambiguous names even in situations where native speakers would equally accept pronouns (i.e., the subject antecedent condition). These results support the view that the interface conditions involved in reactivating and selecting the right antecedent for an ambiguous pronoun may cause processing disadvantage for L2 learners. Compensating for processing costs may lead to reliance on repeated names as an easier alternative.

Zooming in on the nature of processing limitations, Experiment 7 suggests that the difficulty with referential ambiguity of pronouns in L2 learners is not limited to the resolution stage in the two-stage model of anaphor processing (Garrod, 1994; Garrod & Sanford, 1994), but is seen also at the initial stage, during which the potential antecedents are retrieved and superficial anaphoric links are formed. It was speculated that this can be a retrieval problem, and/or a difficulty associated with keeping track of multiple possibilities.

The disadvantage of ambiguous pronouns can also show up in native speakers when the referential ambiguity of a pronoun has a wider scope (Experiment 2). In this situation of processing pressure, native speakers also prefer explicit reference regardless of the accessibility of the antecedent. For this very reason, speakers may make a cooperative effort to design their referring expressions to be as interpretable as possible (Arnold, 2008).

The processing-based account can thus explain a wider range of data, including the processing patterns of both native and non-native speakers. Whether the observed differences between L1 and L2 processing are quantitative or qualitative in nature is not certain. For example, is the high-end of proficiency scale still characterized by non-convergence? In the current study, the high-proficiency group disfavored pronouns to a greater extent than the low-proficiency group. Although this may suggest their effective use of overt referential cues, they seemed unable to take advantage of the fact that pronouns may serve as a better cue than repeated names to discourse coherence in certain situations (Gordon et al., 1993). Research on more proficient L2 learners seems necessary for a better understanding of the question of continuity between the L1 and L2 processing in this domain.³⁶

In certain ways the L2 learners of English perform in a manner very similar to English native speakers. Specifically, the difficulty associated with interpreting an anaphor which had an object antecedent was found consistently across the pronoun and name anaphors, across the experiments, and across the groups. The core principles

³⁶ There is some evidence showing that only skilled readers show the repeated name penalty in the processing of their native language, which suggests skilled readers' ability to make better use of pronouns as a cue to local coherence (Shapiro & Milkes, 2004). This provides some support for the continuity possibility.

governing the information flow and discourse organization in different languages seem universal; the expectation that the subject/topic of the current sentence should be the same as the one in the previous sentence is one of these principles. And an adult L2 learner seems capable of applying this principle in resolving coreference relations in the L2.

To summarize, Experiment 6 and 7 provide support for the hypothesis on interface instability (Sorace & Filiaci, 2006). The observed differences in L2 performance in this study are not explained by incomplete acquisition of the target grammar, suggesting that the difficulties are understood to lie at the processing level rather than at the representational level (Sorace, 2006). As suggested in the Interface Hypothesis, integrating in real-time the necessary syntactic and discourse conditions governing pronouns may pose difficulties, even in a language like English that has relatively simple mappings (Roberts et al., 2008). Importantly, the difficulties cannot be explained by transfer of L1 processing routines. The problem can be better explained by the shortage of processing resources in L2, specifically in retrieving potential antecedents, holding alternatives in the processing buffer, and inhibiting the competitor to commit to one interpretation. As pointed out in Sorace (2008), however, cross-linguistic influence and processing limitations may not be incompatible with each other. These factors need to be addressed independently for bilingual populations of different language pairs in order to better understand the exact nature of interface instability.

CHAPTER 6

GENERAL DISCUSSION

This dissertation investigated the processing of subject anaphors in English and Korean, focusing on the effect of the relative accessibility of potential antecedents and the effect of grammatical ambiguity of pronominal reference. Furthermore, adult Korean speakers of L2 English were tested in order to determine the extent to which their processing of English coreference is comparable to native speakers. In this chapter, the results from Experiments 1 through 7 are summarized. Afterwards, the implications of these results are discussed and future research directions are sketched out.

Summary of Findings

Theoretical and empirical evidence has suggested that there is an inverse relation between the amount of information or the degree of reduction of an anaphor and the accessibility of the discourse referent (Ariel, 1988, 1990; Groz et al., 1995; Gundel et al., 1993; Walker et al., 1998). Experiments 1 and 2 (Chapter 3) investigated whether the function of reduced anaphors, such as pronouns, as a marker for the most accessible antecedent is influenced by their referential ambiguity. Experiment 1 aimed to replicate previous findings that an entity introduced in the subject position is more accessible than an entity in the object position, as measured by the relative ease of comprehension of ambiguous pronouns being used to refer to the subject compared to the object. The second goal was to determine whether there is a preference for referring to an entity in the subject position using a pronoun relative to using a name, even when the pronoun does not syntactically disambiguate its referent. The results revealed a clear preference

for interpreting ambiguous pronouns as referring to the subject, as indicated by shorter reading times in conditions where the pronoun referred to the subject. The results, however, revealed that name anaphors did not result in additional reading time costs compared to ambiguous pronouns in the subject antecedent condition. Both unambiguous names and ambiguous pronouns were processed equally fast to refer to the subject referent in the previous sentence, whereas names but not pronouns were preferred to refer to the object antecedent in the previous sentence. The results suggest that the processing of anaphors is influenced by the relative accessibility of discourse entities, but the prediction that repeated names should hinder the establishment of coreference for a highly accessible entity cannot be generalized to situations where they substitute for ambiguous pronouns, at least in the type of passages investigated in this study.

Experiment 2 further investigated the extent to which the processing of different forms of anaphors was influenced by referential ambiguity and the relative accessibility of referents, using passages in which the ambiguity of a pronoun extended to the entire clause containing it. Another goal was to explore the locus of ambiguity effects with reference to the two-stage models of anaphor processing. The results revealed an overall preference for repeated names in both on- and off-line measures, and in both subject and object antecedent conditions, indicating that the ability of pronouns to coherently refer to subject antecedents may be greatly moderated by the need to uniquely identify the referent of an anaphor. Another finding was that the disadvantage of referential ambiguity of a pronoun was not revealed until readers were required to commit to one interpretation, suggesting that referential ambiguity is more of a resolution problem rather than a problem of initial search for an antecedent.

Experiments 3 through 5 (Chapter 4) investigated how relative accessibility of discourse entities is determined in Korean, focusing on the grammatical role (subject vs. object) and the order of mention (SOV vs. OSV) of an entity. Experiment 3 investigated the interpretation of null pronouns under the assumption that they should prefer as their antecedent an entity that is more accessible. The results demonstrated that the disambiguating region was read faster when null pronouns referred to the subject entity, regardless of whether it was in the sentence initial position or not. Question response accuracy, however, revealed a delayed effect of the order in which discourse entities were introduced or of the information-structural properties associated with different word orders.

In Experiment 4, the processing of null pronouns was compared to the processing of name anaphors in order to explore the cross-linguistic applicability of the notion of a repeated name penalty as a window to accessibility, which was manipulated through grammatical role and word order. The results revealed a general preference for subject antecedents regardless of anaphor and word order. Within the canonical SOV order, no repeated name penalties were observed. On the other hand, in the scrambled OSV order, there were repeated name penalties for both subject and object antecedents, indicating the specialized function of OSV for highlighting its constituents in the information structure, and the function of null pronouns as a marker for an accessible entity.

Experiments 5 addressed the question of whether appropriate discourse contexts in which different word orders can be felicitously integrated can increase the influence of order of mention on accessibility. In addition, Experiment 5 examined whether there still is any processing advantage of null pronouns compared to name anaphors in situations

where the ambiguity of null pronouns is not immediately disambiguated, and at which stage of processing the effect of referential ambiguity emerges. The results consistently revealed the advantage of a subject antecedent, but the advantage was less pronounced in the OSV order, suggesting that felicitous discourse contexts for OSV may increase the likelihood the scrambled object is considered as a good antecedent of an anaphor. There was an overall preference for names, and the disadvantage associated with the referential ambiguity of null pronouns surfaced at the resolution stage.

Experiments 6 and 7 examined the extent to which coreference processing in L2 English by Korean speakers was guided by the accessibility considerations, that are relevant to their L1 (Korean) as well as the L2. Both experiments compared the interpretation of pronouns and names in the subject and object antecedent conditions, but they differed in terms of the scope of pronominal ambiguity. In Experiment 6, the pronominal ambiguity was immediately disambiguated, whereas in Experiment 7, the ambiguity was not resolved until the next clause.

Unlike in native speakers, the L2 learners showed a preference for repeated names in comparison to grammatically ambiguous pronouns, independent of the scope of ambiguity and the grammatical role of the antecedent. The difficulty was greater, however, when the pronoun referred to an entity in the object position, suggesting that L2 processing is also guided by the universal preference for antecedents in subject position.

Experiment 7 further probed whether difficulties associated with referential ambiguity arise at the initial stage of weighing potential antecedents, or at the resolution stage of committing to one interpretation. Unlike in native speakers, increase in reading

times due to pronominal ambiguity started to emerge at the initial stage, which has been assumed to be automatic in L1 processing models.

Implications and Future Directions

Subjecthood

The results of the study consistently provide evidence of the increased accessibility of grammatical subjects. Subject anaphors were preferentially interpreted as coreferential with the preceding sentence's subject both in English and Korean and in L1 and L2. Also, whether the subject appeared sentence initially or not did not affect the initial advantage of subjecthood.

In Ariel's (1988; 1990) accessibility theory, the ease of processing discourse anaphors is modulated by the accessibility of antecedents, which is in part determined by an antecedent's saliency. For Ariel, discourse topics constitute salient entities, but the notion of subjecthood or the relationship between subjecthood and topichood is not discussed further. Gundel et al.'s (1993) givenness hierarchy, which proposes that given information is more salient and can be felicitously referred to by pronoun, does not explain the role of subjects. The lack of details in these theories in part comes from the fact that they were meant to explain the distribution and interpretation of referring expressions in a broader discourse. In centering theory (Grosz et al., 1995; Walker et al., 1998), which focuses on local discourse, subjects are ranked more highly than entities in other positions, but there is no further discussion of what properties of subjects make them more salient. So the question that remains to be answered is why subjects are accorded privileged status.

In fact, there is no consensus regarding the role of grammatical relations like subject and object within linguistic theories even at the level of sentential grammar. For example, in Lexical Functional Grammar (Bresnan, 1982), grammatical relations are assumed as linguistic primitives, while in Government Binding (GB) theory (Chomsky, 1981), they are understood to refer to positions in a phrase structure. Within the GB framework, Carminati (2002) suggested that what makes subject antecedents special is their syntactic position [Spec, IP], based on the interpretational Italian intra-sentential anaphors (outside the binding domain).

Whether grammatical relations are valid primitive concepts or not, the notion of subject cannot be understood on purely structural terms, however, when inter-sentential anaphors are taken into account. There is evidence suggesting that memory for actual surface structure fades quickly when a sentence boundary is crossed, whereas memory for content lasts longer (Sachs, 1967). Processing inter-sentential anaphors, therefore, can be better understood as accessing the level of representation in which the interpretation of a sentence is integrated into a discourse. The prominence of subjects also needs to be understood in a discourse representation.

One way to understand the subjecthood effect may be related to the fact that subjects are usually also topics. Chafe (1976) argued that subjects are cognitively privileged as they signal what a sentence is about, and that other parts of the sentence are understood as providing new information to our knowledge about the subject. In many languages, it has been pointed out that there is a strong correlation between subject and topic, although it is not possible to equate the two (Lambrecht, 1994). Language production models have proposed that the most accessible concept (or topic) is assigned

the highest grammatical function (Bock & Warren, 1985; Bock & Levelt, 1994). The reason why subjects tend to be ranked highly on the animacy and thematic hierarchies also comes in part from a high correlation between these semantic properties of NPs and the likelihood of the NP serving as a topic (Comrie, 1989). Lambrecht (1994) further suggests that when canonical sentences are presented in isolation without contextual or prosodic cues, they are construed as topic-comment sentences. In other words, subjects are unmarked topics and topic-comment structure is the unmarked pragmatic structure (p. 132).

The special status of subject, however, does not seem to be limited to a case where the subject serves as the topic. In the Korean experiments, in which the grammatical object served as given or topical information, readers still preferred to interpret ambiguous pronouns as referring to the subject. The same pattern was found when the OSV order was presented in a discourse context that clearly established the object NP as given. But it can be noted that, in OSV, the focus status of the subject in the information structure can also be highlighted. It is not exactly clear how much the focus status contributed to the observed subject advantage in on-line measures in OSV.

Research has shown that an entity brought into focus by clefting serves as a good antecedent for a pronoun (Arnold, 1998; Foraker & McElree, 2007). Structural focusing may increase the accessibility of the focused element, but there is evidence suggesting that subjecthood matters more than structural focusing (Kaiser, 2006). For example, when a discourse such as “The maid scolded the bride. No, that’s wrong! It was the secretary that she scolded.” was presented followed by ‘She...’, people preferred to provide a subject-referring continuation (i.e., ‘she’ referring to ‘the maid’). Note that in this case,

‘she’ in the cleft sentence serves as a topic as well as occupies the subject position.

Interestingly, people preferred the clefted entity as the antecedent of the pronoun when the topic was not encoded in the grammatical subject position as in “The maid scolded the bride. No, that’s wrong! It was the secretary who scolded her. She...” (Kaiser, 2006). Taken together with the results from current study (Experiments 3, 4 & 5), whereas subjecthood makes both topics and foci good antecedents for a subsequent pronoun, topics or foci alone cannot explain the likelihood of subsequent pronominal reference.

Some researchers have suggested that topicality has to be understood as a continuous property (Givón, 1983). Lambrecht (1994) has argued that there can be more than one topic even within a sentence (cf. Reinhart, 1982). Upon this view, the advantage of subjecthood, even in the presence of what has been traditionally assumed to be more topical/given, can be understood as resulting from the inherent topicality of the subject.

While subjecthood is a powerful determinant of referential accessibility, its role might have been magnified in the current study since the anaphors explored in this study also appeared as subjects. There is evidence suggesting that pronouns prefer antecedents in the same grammatical role (Chamber & Smyth, 1998; Smyth, 1994). Even though a subject preference may emerge independently of structural parallelism (Arnold, 2008; Crawley et al., 1990), its effect has been shown more robustly with subject pronouns. The experiments in this study did not consider anaphors in other grammatical roles, but the results demonstrated that there is a preference even for subject name anaphors as well as pronouns to have an antecedent in the subject position, suggesting that discourse organization indeed favors some sort of parallelism.

Arnold (2010) proposed the Expectancy Hypothesis, according to which accessible entities are those with high expectancy, i.e., that are relatively likely to be mentioned next. The hypothesis focuses on what is likely to be topical, not what was already topical (p. 193). According to this hypothesis, subjects have high expectancy and thus are likely to be mentioned again. One potential problem is its circularity: we are trying to explain why subjects are likely to receive subsequent (pronominal) mention, but the hypothesis explains it is due to subjects' increased likelihood of being mentioned again.

In centering theory, this is termed as the preference for a continue transition (Walker et al., 1998). The results of the current study are congruent with the idea that the subject of a sentence provides a coherent link to a subsequent sentence. Nevertheless, there was a reliable interaction between the grammatical role of the antecedent and the type of the anaphor in the current study (except in L2 processing) showing that a preference for a subject entity (or a dispreference for an object entity) in name anaphors is not as great as in pronouns. These results suggest that these referring expressions mark different degrees of accessibility of their referent, and that grammatical objects are less likely to receive pronominal reference than subjects, which cannot be explained based on transition relations alone.

Of course, many questions remain open. For example, why continue transitions are generally preferred over other types of transitions is not entirely clear. On the view that topicality is a gradient notion and that subjects are inherently topical (Givón, 1983), parallelism can be understood as originating from the increased accessibility of subjects. This view, however, cannot satisfactorily answer why the final representation of the

discourse is more stable when an anaphor has the scrambled object as its antecedent in the off-line measure, which we will turn to shortly. It is also possible that there is a general preference for structural congruence. Investigating non-subject anaphors may provide one venue for clarifying the relationship between different kinds of referential expressions and the level of accessibility of their antecedents in discourse. Finally, more research is needed in order to understand how grammatical relations and information-structural properties, independently or jointly, impact accessibility. Given that prosody is a good way of signaling information-structure, using auditory materials with prosodical cues might be one way of addressing the issue.

Topichood Encoded by Word Order

As just pointed out, on-line results from Korean experiments revealed a striking effect of subjecthood even when there was an apparently more topical element, i.e., a scrambled object. The strong effect of subject on referent accessibility, however, was also shown to be modulated by effects of informational structural properties associated with word order. Specifically, the off-line measures revealed that readers arrived at a more stable representation of the discourse when the subsequent anaphor referred to the topicalized object in OSV. These results have notable theoretical and methodological implications.

First, the results suggest that the effect of information structural properties may matter more in later stages of processing, and that the advantage of subjecthood does not guarantee a more stable discourse representation. Discourse comprehension requires not only building connections between sentences, but also integrating a mental representation of the described events (Zwaan & Rapp, 2006). It can be speculated that building

connections between sentences may be facilitated by having the same subject as a link, but updating the discourse model may revolve around topics. As sentence parsing often takes into account structural properties first with delayed semantic and discourse integration (Ferreira & Clifton, 1986; Frazier & Rayner, 1982), discourse processing of sentences may proceed efficiently without immediately incorporating all the discourse level sources of information. On the assumption that the discourse representation is built around topics, the OSV order followed by a subject referring (subject) anaphor can be more difficult than when it is followed by an object referring (subject) anaphor, because the former requires updating information in relation to two discourse referents/topics, whereas the latter requires just one.

The differences in on- and off-line data suggest that comprehension questions can provide a useful tool for investigating the time-course of how different sources of information are consulted during language processing. Previous studies that dismissed word order effects based only on on-line measures (Kaiser, 2005; Kaiser & Trueswell, in press) should therefore be interpreted with caution. It must also be noted, however, that the information-structural effects might have been delayed because topics were not strongly signaled in the present study. Although scrambling is motivated by givenness (Ferreira & Yoshita, 2003), people usually choose a syntactic structure in which the given information could serve as a syntactic subject, as in the passive structures (Christianson & Ferreira, 2005). There might be limitations on the extent to which word order variations convey different information structures.

Since topic markers can be attached to any constituent to indicate topic elements in a sentence in Korean, and as topic-marked constituents are positioned at the beginning

of a sentence, it would be interesting to see how topic markers increase referent accessibility in conjunction with word order. For example, it would be interesting to investigate whether a topic-marked object in OSV serves as a better antecedent of an anaphor compared to the subject, or an object without topic marking in OSV.

Also, the present study investigated only a local discourse. It remains to be seen how information-structural notions such as topics and foci affect the processing of coreference in a global discourse structure where their discourse functions are highlighted. Given the discourse-driven nature of Korean *pro*-drop, taking global discourse into account would be especially fruitful for understanding the relevant factors related to interpreting *pro*.

Referential Ambiguity

One of the research goals of the dissertation was to examine whether the so-called “repeated name penalty” (Gordon et al., 1992) generalizes to grammatically ambiguous pronouns. Within the subject antecedent condition, the consistent results from both English and Korean experiments on native speakers were that when pronominal ambiguity was immediately disambiguated, both pronouns and names were processed with equal ease, whereas names were preferred over ambiguous pronouns when disambiguation was delayed. The only case that revealed a repeated name penalty was the Korean OSV condition for both subject and object antecedents in Experiment 4, which tested null pronouns and repeated names in contexts where the referent of null pronouns could be easily identified. These results are theoretically informative in terms of the insight they offer into the role of referential ambiguity and accessibility in processing different forms of anaphors.

The results suggest that the ease or difficulty of establishing coreference using different types of anaphors varies depending on referential ambiguity as well as the relative accessibility of discourse entities. The results are generally consistent with the view that when the antecedent is accessible in the discourse model, the ease of establishing coreference using a pronoun increases relative to when the antecedent is less accessible, whether or not the pronoun is ambiguous (Walker et al., 1998). However, Gordon et al.'s (1993) claim that there would be a significant disadvantage for using coreferential names for the most accessible entity of an utterance seems oversimplified, and cannot explain why readers accept coreferential names as much as, or more than, grammatically ambiguous pronouns in some situations.

Gundel et al.'s (1993) givenness hierarchy makes more precise predictions regarding the use of referring expressions. As reviewed in the literature review section (Chapter 2), according to the givenness hierarchy, the form of referring expressions depends on the assumed cognitive status of the referent, which varies from low (type identifiable) to high (in focus). Gundel et al. argue that each cognitive status entails all lower statuses, and hence a particular form can be replaced by forms which require a lower status. They suggest that the givenness hierarchy interacts with Grice's maxim of quantity (Grice, 1975), according to which one should be as informative as required, but not more than is required. The results obtained in the present study provide support for the predictions of the givenness hierarchy, in terms of the implicational nature of referring expressions, and of the influence of both accessibility and ambiguity-avoidance considerations on reference processing.

There is good evidence that both language production and comprehension systems are sensitive to the ambiguity of referring expressions. In production, it has been observed that speakers and writers tend to rely on more explicit reference in contexts where use of a pronoun does not uniquely identify one referent (Arnold, 1998; Arnold et al., 2000). The tendency to avoid referential ambiguity in production is mirrored in processing as well. For example, ambiguous sentences with no gender cues on the pronoun require significantly more reading time than the unambiguous sentences with gender cues (Matthews & Chodorow, 1988). The goal of communication is, after all, to get the message across, and ambiguity does not help. The lack of repeated name penalty with ambiguous pronouns then does not come as much of a surprise.

The results also suggest that referential ambiguity is not a monolithic notion that can be defined at the level of textual features such as the number of potential antecedents or the amount of information in an anaphor. It can be better understood within the mental model being built by the reader, and hence, closely interacts with the accessibility of each referent. Specifically, the observed advantage of using null pronouns over repeated names in Korean OSV suggests that there are cases where formally ambiguous null pronouns can more efficiently retrieve highly accessible entities in the mental model. The discourse-driven nature of Korean *pro*-drop may be better understood in contexts where associated information-structural properties are well signaled. However, there do not seem to be clear criteria that can define what constitutes the right discourse context for the felicitous use of null pronouns. Further research is needed to shed light on the issue of how to define the ‘right’ condition for *pro*-drop. Comparing the processing of null

pronouns and less reduced referring expressions like names offers a useful tool for investigating the issue.

There are a number of other issues that remain open. This study used a clause-by-clause self-paced reading task, which might not be able to provide high temporal resolution of language processing as it unfolds in real time. Measures such as eye-tracking or ERP might be able to provide insight into whether different referring expressions have any early processing consequences on establishing coreference. Another issue that would benefit from future research is how much the processing strategies of coreference are shared between language comprehension and production. The extent to which accessibility and ambiguity considerations impact the choice of referring expression in language production remains to be explored.

L1 vs. L2 Processing of Coreference

Experiments 6 and 7 revealed both similarities and differences between L1 and L2 coreference processing. The Korean L2 learners of English found it easier to process subject referring anaphors than object referring anaphors, as did the native speakers, and also as they did in Korean. If L2 processing is characterized by limited processing resources, one might speculate that the physical proximity of the object entity and the anaphor in question would increase the availability of the object as an antecedent. No such recency effect was observed regardless of L2 proficiency.

As discussed earlier, the way in which grammatical functions are assigned to conceptual arguments is not arbitrary in the world's languages; it is the topic that is usually encoded in a syntactically prominent position (Lambrecht, 1994; Levelt, 1989). Speakers/writers formulate their messages by adding additional information to the most

accessible concept, i.e., topics. Readers/listeners expect to update their mental models by attaching new information to given/topical information. The flow of information in a sentence and discourse is understood to be an emergent phenomenon, based ultimately on universals of human cognition (Tomasello, 2003). L2 learners should also bring the same set of expectations when they process the target language.

The results also revealed that processing coreference in L2 was different from processing in L1 in some important ways. The L2 learners had difficulty with grammatically ambiguous pronouns relative to repeated names even within the subject antecedent condition and even when the pronouns were immediately disambiguated. In addition, difficulty with pronominal ambiguity surfaced earlier in L2 processing than in L1 processing. These results shed insight into why L2 processing of pronominal reference is difficult and whether there is continuity between the L1 and L2 processing of coreference.

In the discussion section of the two L2 experiments (Chapter 5), it was pointed out that the difficulty with pronominal reference cannot be attributed to incomplete knowledge in L2. This study did not test the participants' metalinguistic knowledge of English pronouns, but other studies have shown that adult L2 learners can master the appropriate use of pronouns in English (e.g., Johnson & Newport, 1989). Also, the pronominal system in English is understood to be relatively less complex than that in other languages (Roberts et al., 2008). The L2 learners in this study could be considered to be fairly proficient in English: they were undergraduate or graduate students recruited from a prestigious university in the US, reported English as their most highly proficient L2, and their mean cloze test score was .81. There is no doubt that they had had

considerable exposure to different types of English pronouns, including inter-sentential subject pronouns investigated in this study. The L2 English learners processed English more slowly than the native speakers, but a slowed capacity account is not capable of offering any explanations, for example, regarding why pronouns are read more slowly than names.

It has been generally acknowledged that L2 processing as such imposes a high load on processing resources due to lack of automaticity. In L1 processing, a prevalent assumption is that operations over many components proceed at least in part automatically, including lexical access, syntactic parsing, semantic integration, anaphor resolution, and inferencing (Rawson, 2004). Automaticity is often defined along psychological dimensions, such as speed, effort, obligatory operation, availability to awareness, extent to conscious control, and attentional demands (Rawson, 2004). In anaphor processing, it has been assumed that a pronoun automatically generates potential antecedents in a local discourse, whereas inhibiting competitors may come with measurable processing cost (Greene et al., 1992; Nicol & Swinney, 2003). The results from the native speakers in this study were compatible with this view: pronominal ambiguity did not delay the processing of the ambiguous region, which can be understood as an automatic generation of potential antecedents. On the other hand, the L2 learners slowed down within the ambiguous region, suggesting that L2 processing of pronouns may not be as automatic as in L1 processing.

Lack of automaticity places demands on processing resources, leaving scant cognitive capacity (such as working memory and allocation of attention) available for storing discourse entities in memory, retrieval of grammatically compatible antecedents,

weighing alternative interpretations, and using other sources of information to arrive at the correct interpretation. Name anaphors can reduce the amount of cognitive load on the processor as they can compensate for fading representations of antecedent information. Names also do not require any grammatical feature matching. As this study only investigated Korean L2 learners of English, however, the claim that pronominal reference should place additional processing demands for a L2 processor needs to be bolstered by the comparison of a wider range of L1-L2 pairs.

All of the components of interpreting pronouns would require additional attention and effort from the learner, but the present study does not provide in-depth information regarding these processes. Using techniques like eye-tracking that can tap into more natural reading processes will help further shed light on the exact nature of the observed difficulties. For example, it would be interesting to see whether ambiguous pronouns generate more regressive eye-movements in L2 learners than in native speakers possibly due to less automatic retrieval of possible antecedents. Also, it remains for future research to examine how L2 learners interpret morphologically unambiguous pronouns in order to better understand whether L2 learners can efficiently use gender cues to limit the set of potential antecedents.

Limited processing resources can be viewed as a general learner characteristic that follows from less automatic and less efficient processing routines in L2. Although unexplored in the current study, individual variations in working-memory (Just & Carpenter, 1992) may turn out to be relevant to obtain a clear picture. Investigation of issues such as the relationship between proficiency and working memory and their independent effects on L2 coreference processing may prove especially enlightening.

Let us now turn to the issue of whether L1 and L2 processing of coreference are qualitatively different or not. Within the context of the present study, there were indications that L2 learners were qualitatively different from the native speakers. In addition to the apparent lack of automaticity, for example, even the high proficiency group showed processing patterns that diverged from those of the native speakers. However, on the assumption that proficiency is a gradient variable, it seems that more data are needed from adult L2 learners with even higher proficiency before it can be concluded that L2 processing is qualitatively different from L1 processing. Although cloze tests are widely used as a measure of L2 proficiency, complementary measures of proficiency might prove helpful for defining and understanding the construct of proficiency.

Another way of looking at the possibility of continuity between L1 and L2 processing of coreference is whether limited processing resources can force even native speakers to resort to more explicit reference. In Experiment 2, it was shown that the native speakers also preferred name anaphors in the face of delayed disambiguation of pronominal reference, which requires holding an unsettled interpretation in the processing buffer while processing other materials. Additional support comes from Shapiro and Milkes (2004), who showed that only skilled readers are interfered with by the absence of anaphoric reference.

In production, speakers are less likely to use pronouns when their processing resources are taxed by utterance planning or a secondary task (Arnold, 2010). Arnold and Griffin (2007) showed that participants did not produce pronouns as frequently when they were asked to tell a story about a cartoon containing two characters of a different gender

relative to when they told a story about a cartoon containing just one character. These results suggest that the mere presence of additional characters can impose a processing load on the speaker independently of ambiguity considerations, which in turn increases the explicitness of referential forms. These observations suggest that cognitive resource-related constraints are relevant not only in L2 processing of referential forms, but also in L1 processing.

Taken together, the results of the present study provide some challenges for current L2 processing models. Under one influential hypothesis on L2 processing, the Shallow Structure Hypothesis, the syntactic representations built by L2 learners are shallower and less detailed than those built by native speakers (Clahsen & Felser, 2006). It is, however, possible that limitations in processing resources might be one of the reasons adult L2 learners fall back on this shallow representation (Dowens, 2006). The results of the current study, and other studies on the Interface Hypothesis (Sorace & Filiaci, 2006), suggest that coordination of interface knowledge overloads L2 processing capacity, forcing the L2 interface representation to be “shallower.” Rather than having a separate model for syntax, and another for the syntax-discourse interface, it seems that we need an L2 processing model that can explain related data in a more parsimonious way (cf. Sorace, 2006).

Furthermore, the current study showed that L2 learners’ preference for explicit forms was independent of L1-L2 differences, suggesting that the emphasis on cross-linguistic interference in some of the works on the Interface Hypothesis require reevaluation. Anaphors plays an important role in forming discourse cohesion and promoting local discourse coherence (e.g., van Dijk & Kintsch, 1983). A closer look at

adult L2 learners' referential maintenance strategies in both comprehension and production is expected to serve as the first step towards proper attention and pedagogy in this area. Also, pedagogical attention should not be limited to L2 forms that are different from the learner's L1 repertoires.

Final Remarks

The relative accessibility of discourse entities provides a useful guideline for processing referential forms. While the linguistic context of the discourse strongly determines accessibility, it is not entirely input driven. Accessibility is represented in the mental model of a reader as s/he interacts with the text, and the reader internal characteristics such as resource-related constraints may mediate the representation of accessibility and its effects on coreference processing, including whether a particular referential form is viewed as ambiguous or not. After all, coherence is not entirely a property of the text. Coherent texts make sense to the reader. Coherence should be understood as a subjective notion in the sense that "interpretation" depends on the interaction between the text and the reader (van Dijk, 1980).

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APPENDIX A

Materials for Experiments 1 & 6

1.
 - a. There was a burglary in the neighborhood last night.
 - b. Patrick warned Matthew to always stay alert.
 - c. He / Patrick was concerned with Matthew's carelessness.
 - c'. He / Matthew paid close attention to Patrick's warnings.
 - d. It is much better to prevent crime before it is committed.
2.
 - a. An unexpected shower started to pour.
 - b. Amanda waited for Tiffany as class was over.
 - c. She / Amanda wanted to share Tiffany's umbrella.
 - c'. She / Tiffany had offered Amanda a ride home.
 - d. The rain continued throughout the afternoon.
3.
 - a. The computer seemed to have caught a virus.
 - b. Ben called Matt for help.
 - c. He / Ben asked Matt to take a look at the computer.
 - c'. He / Matt asked Ben what the problem was.
 - d. A lot of important data seemed to be missing.
4.
 - a. The discussion got a bit heated yesterday.
 - b. Paul apologized profusely to Josh.
 - c. He / Paul had been very rude to Josh.
 - c'. He / Josh had been offended by Paul's comment.
 - d. They had very different political views.
5.
 - a. After-Christmas sales were going on.
 - b. Sue saw Ann at the mall.
 - c. She / Sue called Ann's name loudly.
 - c'. She / Ann didn't seem to recognize Sue.
 - d. It's been a while since they talked to each other.
6.
 - a. It was Halloween weekend.
 - b. Debora dressed Emily like a bumblebee.
 - c. She / Debora took pictures of Emily in the costume.
 - c'. She / Emily posed for Debora to take pictures.
 - d. Kids were already out on the street asking for candy.
7.
 - a. Christmas was just around the corner.
 - b. Eric gave Fred a hamster as a gift.
 - c. He / Eric hoped that Fred would feel less lonely.
 - c'. He / Fred asked Eric what to feed the hamster.
 - d. It was a tiny baby hamster.
8.
 - a. The commencement ceremony was held this weekend.
 - b. Susan treated Karen to a nice meal.
 - c. She / Susan wanted to congratulate Karen's graduation.
 - c'. She / Karen was grateful to Susan for her friendship.
 - d. The restaurant was full with newly graduates and their families.

9. a. There was a chess tournament in the community.
b. Robert defeated Arthur in a close match.
c. He / Robert was more strategic than Arthur.
c'. He / Arthur had poor strategies compared to Robert's.
d. The next round was to begin soon.
10. a. Winter break has begun.
b. Heather sent Tiffany a postcard from Hawaii.
c. She / Heather wished Tiffany could come there too.
c'. She / Tiffany envied Heather enjoying warm weather.
d. Hawaii is a great place to be in winter.
11. a. A piano recital was held in a local church.
b. Justin cheered Edward enthusiastically.
c. He / Justin clapped excitedly as Edward finished playing.
c'. He / Edward waved at Justin appreciatively.
d. All the participants delivered a wonderful performance.
12. a. Guests should be arriving soon for a barbeque party.
b. Carmen sent Diana to buy some more charcoal.
c. She / Carmen told Diana to hurry up.
c'. She / Diana helped Carmen the whole day.
d. The weather was perfect for an outdoor party.
13. a. Every one had a nice summer break.
b. Bill showed Tom some of the pictures from the vacation.
c. He / Bill told Tom stories behind the pictures.
c'. He / Tom asked Bill about stories behind the pictures.
d. Other students showed interest in the pictures, too.
14. a. A new shopping mall opened in town.
b. Carol asked Jackie to go to the mall together.
c. She / Carol wanted to get Jackie's help selecting a winter coat.
c'. She / Jackie helped Carol in selecting a winter coat.
d. The weather was getting cold.
15. a. There was a bullying incident at the school.
b. Wayne confronted Charles about the incident.
c. He / Wayne believed that Charles was involved.
c'. He / Charles spread rumors that Wayne was involved.
d. School officials were looking into the incident.
16. a. The whole team was working on an important deal.
b. Bill wanted John to look over some important papers.
c. He / Bill trusted John more than anyone else.
c'. He / John got Bill's trust through his hard work.
d. No error was acceptable in the documents.
17. a. An informative health seminar was held last week.
b. Jill urged Beth to quit smoking after the seminar.
c. She / Jill repeated to Beth how destructive smoking is.
c'. She / Beth took Jill's advice seriously this time.
d. Support from friends can help one quit smoking

18.
 - a. It was the peak of moving season for college students.
 - b. Ellen helped Jessica move the furniture.
 - c. She / Ellen also helped Jessica unpack.
 - c'. She / Jessica treated Ellen a nice meal after the moving.
 - d. The new place was a lot more spacious.
19.
 - a. It was a quiet night.
 - b. Rachel read Susan a bedtime story.
 - c. She / Rachel had a very soothing voice and Susan fell asleep soon.
 - c'. She / Susan fell asleep before Rachel finished reading the story.
 - d. The family dog also fell asleep next to the bed.
20.
 - a. The lecture was quite boring.
 - b. Louis poked Simon in the rib.
 - c. He / Louis wanted to sneak out with Simon.
 - c'. He / Simon woke up from dozing and looked at Louis.
 - d. The professor seemed annoyed.
21.
 - a. Many students were waiting for a bus home.
 - b. Joshua waved hi to Robert.
 - c. He / Joshua asked Robert what time it was.
 - c'. He / Robert lived in the same neighborhood as Joshua.
 - d. They chatted as they were waiting for the bus.
22.
 - a. The summer camp for children has started.
 - b. Janet informed Allie about the field trip to an orchard.
 - c. She / Janet gave Allie a list of things to bring.
 - c'. She / Allie asked Janet what to bring on the field trip.
 - d. The kids were excited about the field trip.
23.
 - a. The public library offers a lot of useful programs.
 - b. Bill advised John to join a book club.
 - c. He / Bill emphasized the benefits of the club to John.
 - c'. He / John asked Bill about the benefits of the club.
 - d. It helps to get different perspectives on a book.
24.
 - a. Most freshmen live with roommates in a dorm.
 - b. Molly promised Elena to clean the room.
 - c. She / Molly knew Elena had cleaned the room before.
 - c'. She / Elena wanted Molly to clean the room this time.
 - d. Getting along well with a roommate is a challenge for just about everybody.

Materials for Experiments 2 & 7

1.
 - a. There was an end of semester party.
 - b. Jessica made Sarah laugh with a joke.
 - c. She / Jessica was a rather serious person // but was playful with Sarah.
 - c'. She / Sarah was a rather serious person // but was playful with Jessica.
 - d. Everybody at the party had fun.
 - e. Who was a serious person? 1. Jessica 2. Sarah

2.
 - a. There was no class at school.
 - b. Paul decided to take Rick to a park.
 - c. He / Paul got very thirsty // and asked Rick if he also wanted to get some drinks.
 - c'. He / Rick got very thirsty // and asked Paul if he also wanted to get some drinks.
 - d. It was a very hot day.
 - e. Who got thirsty? 1. Paul 2. Rick
3.
 - a. The junior tennis championship was going to be held soon.
 - b. Tom coached Brian for the match.
 - c. He / Tom was always hardworking // and took good care of Brian.
 - c'. He / Brian was always hardworking // and was respectful of Tom.
 - d. They really wanted to win.
 - e. Who was hardworking? 1. Tom 2. Brian
4.
 - a. Some children were playing at the playground.
 - b. Lucy scratched Emily on the face.
 - c. She / Lucy had always wanted to ride a bike // and tried to take Emily's bike by force.
 - c'. She / Emily had always wanted to ride a bike // and tried to take Lucy's bike by force.
 - d. They both cried.
 - e. Who wanted to ride a bike? 1. Rucy 2. Emily
5.
 - a. Students were doing an art project.
 - b. Lindsay tickled Carol with a brush.
 - c. After she / Lindsay finished her drawing, // she wanted to play with Carol.
 - c'. After she / Carol finished her drawing // she started to play with Lindsay.
 - d. They were good friends.
 - e. Who finished her drawing? 1. Lindsay 2. Carol
6.
 - a. There was a fire at a dormitory.
 - b. Rick saved Steve from the fire.
 - c. He / Rick got a severe burn // but he was happy that he saved Steve.
 - c'. He / Steve got a severe burn // but he was thankful to Rick for his life.
 - d. It took a while until the fire was brought under control.
 - e. Who got a severe burn? 1. Rick 2. Steve
7.
 - a. There was a soccer tournament over the weekend.
 - b. Fred attacked Luke during a match.
 - c. He / Fred was a midfielder on his team // and tried to steal the ball from Luke.
 - c'. He / Luke was a midfielder on his team // and tried to steal the ball from Fred.
 - d. It was a very competitive match.
 - e. Who was a midfielder of the team? 1. Fred 2. Luke
8.
 - a. There was an accident on the hunting trip.
 - b. John shot Ken by mistake.
 - c. As he / John was chasing a deer, // he fired at Ken accidentally.
 - c'. As he / Ken was chasing a deer, // he got shot by John accidentally.

- d. There was heavy fog.
e. Who was chasing a deer? 1. John 2. Ken
9. a. It was a cold winter day.
b. Jane waited for Hillary for one hour.
c. Because she / Jane lost her cell phone, // she could not call Hillary.
c'. Because she / Hillary lost her cell phone, // she could not call Jane.
d. They never did find each other.
e. Who lost her cell phone? 1. Jane 2. Hillary
10. a. The bell had rung and students were heading home.
b. Mark grabbed Ryan from behind.
c. He / Mark was upset // and shouted at Ryan.
c'. He / Ryan was upset // and shouted at Mark.
d. Other students gathered around.
e. Who was upset? 1. Mark 2. Ryan
11. a. There was nobody home but the mischievous brothers.
b. Paul pushed Dan while they were watching TV.
c. He / Paul was the youngest among his siblings // and was upset with Dan.
c'. He / Dan was the youngest among his siblings // and had teased Paul first.
d. Not a single day went by without a fight.
e. Who was the youngest among his siblings? 1. Paul 2. Dan
12. a. There was a story on the news about a murder.
b. Fred killed Charles out of anger.
c. He / Fred was a waiter at a bar // and got into an argument with Charles.
c'. He / Charles was a waiter at a bar // and got into an argument with Fred.
d. The police are still investigating the case.
e. Who was a waiter at a bar? 1. Fred 2. Charles
13. a. Students were learning how to draw portraits.
b. Lucy drew Paula with a pencil.
c. She / Lucy did not like the portrait that much // and felt sorry for Paula.
c'. She / Paula did not like the portrait that much // and blamed Lucy.
d. The portrait was not that bad actually.
e. Who did not like the portrait? 1. Paula 2. Lucy
14. a. It was time for lunch.
b. Susan visited Emily briefly.
c. She / Susan bought two coffees // and handed one to Emily.
c'. She / Emily bought two coffees // and handed one to Susan.
d. The coffee shop was crowded with office workers.
e. Who bought two coffees? 1. Emily 2. Susan
15. a. It was a dark night.
b. Bill followed Nate secretly.
c. He / Bill was a rather large man // but was more agile than Nate.
c'. He / Nate was a rather large man // but was more agile than Bill.
d. The streets were very silent.
e. Who was a large man? 1. Nate 2. Bill
16. a. There was an alumni reunion.
b. Amy greeted Liz with a hug.

- c. She / Amy wanted to catch up, // but had to leave before Liz for another appointment.
- c'. She / Liz wanted to catch up, // but had to leave before Amy for another appointment.
- d. Others were busy talking about the old days.
- e. Who wanted to catch up on things? 1. Liz 2. Amy
- 17. a. Soon there was going to be final exam week.
- b. Frank taught Paul mathematics.
- c. Because he / Frank did not sleep well last night, // he could not stop yawning in front of Paul.
- c'. Because he / Paul did not sleep well last night, // he could not stop yawning in front of Frank.
- d. There still was a lot to be covered.
- e. Who did not sleep well last night? 1. Paul 2. Frank
- 18. a. The spring break had started.
- b. Kate invited Amy to dinner.
- c. She / Kate was on diet // and gave her portion of dessert to Amy.
- c'. She / Amy was on diet // and gave her portion of dessert to Kate.
- d. It was a delicious looking chocolate cake.
- e. Who was on diet? 1. Amy 2. Kate
- 19. a. It was an early morning.
- b. Rachel gave Jennifer a ride to the airport.
- c. She / Rachel took out some snacks // and shared them with Jennifer.
- c'. She/ Jennifer took out some snacks // and shared them with Rachel.
- d. They did not have time to eat breakfast.
- e. Who took out some snacks? 1. Jennifer 2. Rachel
- 20. a. The first snow of the season fell overnight.
- b. Mike threw Ryan a snowball.
- c. He / Mike stood right behind a tree // and dodged Ryan's counterattacks.
- c'. He / Ryan stood right behind a tree // and dodged Mike's attack.
- d. Other kids joined their snowball fight.
- e. Who stood behind a tree? 1. Ryan 2. Mike
- 21. a. School finished early today.
- b. Dana took Lisa to a movie.
- c. She / Dana felt sleepy in the middle // and leaned against Lisa's shoulder.
- c'. She / Lisa felt sleepy in the middle // and leaned against Dana's shoulder.
- d. The movie was rather boring.
- e. Who felt sleepy in the middle of the movie? 1. Lisa 2. Dana
- 22. a. The flight arrived on time.
- b. Jennifer hugged Katie tightly.
- c. She / Jennifer came back from a long trip // and had lots of stories for Katie.
- c'. She / Katie came back from a long trip // and had lots of stories for Jennifer.
- d. The stories were quite exciting.
- e. Who came back from a trip? 1. Katie 2. Jennifer

23. a. Some kids were playing with toys.
b. Laura bit Sandy on the arm.
c. She / Laura was bored with her own toys // and tried to take Sandy's by force.
c'. She / Sandy was bored with her own toys // and tried to take Laura's by force.
d. They did not want to share.
e. Who was bored with her toys? 1. Sandy 2. Laura
24. a. There was a baseball game last night.
b. Ray had to pay Joe 5 dollars.
c. He / Ray did not have much cash // but unfortunately lost a bet with Joe.
c'. He / Joe did not have much cash // but fortunately won a bet with Ray.
d. Team USA lost in the semi-final against team Japan.
e. Who did not have much cash? 1. Joe 2. Ray

APPENDIX B

Materials for Experiment 3

1.
 - a. 현정이가 은주를 농담을 하며 웃겼다.
 - a'. 은주를 현정이가 농담을 하며 웃겼다.
 - b. 늘 심각한 편인데
 - c. 은주에게는 농담을 잘했다.
 - c'. 현정에게는 잘 웃어 주었다.
 - d. 누가 늘 심각한 편인가? 1. 현정 2. 은주
2.
 - a. 태우가 재훈이를 방학동안 지도했다.
 - a'. 재훈이를 태우가 방학동안 지도했다.
 - b. 언제나 성실하였고
 - c. 재훈이를 잘 돌봤다.
 - c'. 태우를 잘 따랐다.
 - d. 누가 언제나 성실하였나? 1. 태우 2. 재훈
3.
 - a. 서연이가 유진이를 공원에 데려갔다.
 - a'. 유진이를 서연이가 공원에 데려갔다.
 - b. 목이 매우 말라서
 - c. 서연에게 음료수를 사오게 했다.
 - c'. 유진이에게 음료수를 사오게 했다.
 - d. 누가 목이 말랐나? 1. 유진 2. 서연
4.
 - a. 상훈이가 축구경기중 영식이를 공격했다.
 - a'. 영식이를 상훈이가 축구경기중 공격했다.
 - b. 팀의 미드필더였는데
 - c. 영식의 공을 뺏고자 했다.
 - c'. 상훈의 공을 뺏으려 했다.
 - d. 누가 팀의 미드필더였나? 1. 상훈 2. 영식
5.
 - a. 미란이가 현정이를 붓으로 간지럽혔다.
 - a'. 현정이를 미란이가 붓으로 간지럽혔다.
 - b. 그림을 그리다가
 - c. 현정에게 자꾸 장난을 쳤다.
 - c'. 미란을 향해 돌아 보았다.
 - d. 누가 그림을 그리고 있었나? 1. 현정 2. 미란
6.
 - a. 수동이가 준호를 화재에서 구했다.
 - a'. 준호를 수동이가 화재에서 구했다.
 - b. 심하게 화상을 당했으나
 - c. 준호를 구할 수 있어 기뻐다.
 - c'. 수동의 덕분에 목숨은 건졌다.
 - d. 누가 심하게 화상을 당했나? 1. 준호 2. 수동
7.
 - a. 은정이가 영희를 매우 그리워했다.
 - a'. 영희를 은정이가 매우 그리워했다.
 - b. 직장을 그만 둔 후
 - c. 영희의 생각이 자주 났다.
 - c'. 은정에게 연락이 없었다.
 - d. 누가 직장을 그만 두었나? 1. 영희 2. 은정

8. a. 철수가 영호를 세계 할퀴었다.
a'. 영호를 철수가 세계 할퀴었다.
b. 모자를 쓰고 있었는데
c. 영호에 밀려 모자가 벗겨졌다.
c'. 철수에 밀려 모자가 벗겨졌다.
d. 누가 모자를 쓰고 있었나? 1. 영호 2. 철수
9. a. 미영이가 은정이를 이미 용서했다.
a'. 은정이를 미영이가 이미 용서했다.
b. 시험에서 이긴 후
c. 은정에게 너그려워졌다.
c'. 미영이를 무시했었다.
d. 누가 시험에서 이겼나? 1. 은정 2. 미영
10. a. 영호가 수동이를 문쪽으로 밀었다.
a'. 수동이를 영호가 문쪽으로 밀었다.
b. 형제들 중 막내였는데
c. 형인 수동이에게 화가 나 있었다.
c'. 형인 영호에게 건방지게 굴었다.
d. 누가 형제들 중 막내였나? 1. 영호 2. 수동
11. a. 소영이가 실수로 미란이를 쏘았다.
a'. 미란이를 소영이가 실수로 쏘았다.
b. 집을 구하는 중에
c. 미란이네 집에 지내고 있었다.
c'. 소영이네 집에 지내고 있었다.
d. 누가 집을 구하는 중이었나? 1. 소영 2. 미란
12. a. 준호가 동현이를 뒤에서 잡았다.
a'. 동현이를 준호가 뒤에서 잡았다.
b. 크게 소리를 지르며
c. 동현에게 화를 내었다.
c'. 준호에게 화를 내었다.
d. 누가 크게 소리를 질렀나? 1. 동현 2. 준호
13. a. 유진이가 소영이를 30 분동안 기다렸다.
a'. 소영이를 유진이가 30 분동안 기다렸다.
b. 전화를 걸어서
c. 소영에게 빨리 오라고 했다.
c'. 유진에게 미안하다고 했다.
d. 누가 전화를 걸었나? 1. 유진 2. 소영
14. a. 영식이가 태우를 여러차례 설득했다.
a'. 태우를 영식이가 여러차례 설득했다.
b. 직장을 옮기고 싶어
c. 태우에게 취직을 부탁했다.
c'. 영식에게 사직서를 제출했다.
d. 누가 직장을 옮기고 싶었나? 1. 태우 2. 영식
15. a. 지영이가 서연이를 잘 이해했다.
a'. 서연이를 지영이가 잘 이해했다.
b. 한국어 실력이 늘어서
c. 이제는 서연의 말을 알아들을 수 있었다.
c'. 이제는 지영을 이해시킬 수 있었다.
d. 누가 한국어 실력이 늘었나? 1. 서연 2. 지영

16. a. 재훈이가 철수를 실수로 죽였다.
a'. 철수를 재훈이가 실수로 죽였다.
b. 혼자 산책을 하던 중
c. 철수와 싸움이 붙었다.
c'. 재훈이와 싸움이 붙었다.
d. 누가 혼자 산책을 했나? 1. 재훈 2. 철수
17. a. 현주가 지영이를 인터뷰에서 거절했다.
a'. 지영이를 현주가 인터뷰에서 거절했다.
b. 매우 무례하여서
c. 지영이의 기분을 상하게 했다.
c'. 현주의 기분을 상하게 했다.
d. 누가 매우 무례하였나? 1. 지영 2. 현주
18. a. 정수가 기동이를 정성껏 치료했다.
a'. 기동이를 정수가 정성껏 치료했다.
b. 수염을 기르고 있어
c. 기동이보다 나이가 들어 보였다.
c'. 정수보다 나이가 들어 보였다.
d. 누가 수염을 기르고 있었나? 1. 정수 2. 기동
19. a. 은주가 미영이를 계속 따라갔다.
a'. 미영이를 은주가 계속 따라갔다.
b. 눈길에 미끄러져서
c. 미영이의 팔을 붙잡았다.
c'. 은주의 팔을 붙잡았다.
d. 누가 눈길에 미끄러졌나? 1. 은주 2. 미영
20. a. 기동이가 화실에서 성민이를 그렸다.
a'. 성민이를 기동이가 화실에서 그렸다.
b. 자꾸 기침이 나서
c. 성민에게 쉬었다 하자고 말했다.
c'. 기동에게 쉬었다 하자고 말했다.
d. 누가 기침이 났나? 1. 성민 2. 기동
21. a. 영희가 민정이를 유심히 관찰했다.
a'. 민정이를 영희가 유심히 관찰했다.
b. 자리에서 일어날 때
c. 민정이와 눈이 마주쳤다.
c'. 영희와 눈이 마주쳤다.
d. 누가 자리에서 일어났나? 1. 민정 2. 영희
22. a. 성민이가 상훈이를 집에 돌려보냈다.
a'. 상훈이를 성민이가 집에 돌려보냈다.
b. 문을 콧 닫으며
c. 상훈에게 인사도 안하고 들어갔다.
c'. 성민에게 인사도 안하고 나왔다.
d. 누가 문을 콧 닫았나? 1. 상훈 2. 성민
23. a. 민정이가 현주를 잠시 방문했다.
a'. 현주를 민정이가 잠시 방문했다.
b. 광고계에 일했는데
c. 현주의 조언이 필요했다.
c'. 민정의 도움을 구했었다.
d. 누가 광고계에 있었나? 1. 민정 2. 현정

24. a. 동현이가 정수를 몰래 미행했다.
 a'. 정수를 동현이가 몰래 미행했다.
 b. 몸집이 큰 편이었으나
 c. 정수보다 행동은 민첩했다.
 c'. 동현보다 행동은 민첩했다.
 d. 누가 몸집이 큰 편이었나? 1. 동현 2. 정수

Materials for Experiment 4

1. a. 최근에 빈 사무실에 도둑이 들었다.
 b. 동수가 진호에게 조심하라고 주의를 주었다.
 b'. 진호에게 동수가 조심하라고 주의를 주었다.
 c. (동수가) 진호의 부주의함이 걱정이 되었다.
 c'. (진호가) 동수의 충고를 주의깊게 들었다.
 d. 범죄는 미리 방지하는 것이 좋다.
2. a. 퇴근 무렵 갑자기 비가 내리기 시작했다.
 b. 영진이가 수민이를 회사 앞에서 기다렸다.
 b'. 수민이를 영진이가 회사 앞에서 기다렸다.
 c. (영진이가) 수민이의 차를 같이 타고 가고 싶었다.
 c'. (수민이가) 영진이에게 차로 태워다 준다고 말했었다.
 d. 비는 밤 늦게까지 계속되었다.
3. a. 지하철이 퇴근 인파로 붐볐다.
 b. 동철이가 영수를 역에서 우연히 만났다.
 b'. 영수를 동철이가 역에서 우연히 만났다.
 c. (동철이가) 영수에게 차를 마시러 가자고 했다.
 c'. (영수가) 동철에게 차를 마시러 가자고 했다.
 d. 오랜만에 할 이야기가 많았다.
4. a. 회의에서 팀원들 간에 의견충돌이 있었다.
 b. 수정이가 민숙에게 회의 후 사과했다.
 b'. 민숙에게 수정이가 회의 후 사과했다.
 c. (수정이가) 민숙에게 너무 무례했었다.
 c'. (민숙이가) 수정에게 감정이 상했었다.
 d. 의견 차이가 너무 컸다.
5. a. 자동차 시동이 걸리지 않았다.
 b. 정환이가 희준에게 도와달라고 부탁했다.
 b'. 희준에게 정환이가 도와달라고 부탁했다.
 c. (정환이가) 희준에게 무엇이 문제인지 설명했다.
 c'. (희준이가) 정환에게 무엇이 문제인지 물었다.
 d. 차 배터리가 방전된 듯 했다.
6. a. 연극 준비로 무대 뒤가 분주했다.
 b. 경은이가 지선이를 곱으로 분장시켰다.
 b'. 지선이를 경은이가 곱으로 분장시켰다.
 c. (경은이가) 지선이의 사진을 찍어 주었다.
 c'. (지선이가) 경은에게 사진을 찍어달라고 했다.
 d. 분장이 매우 귀여웠다.
7. a. 크리스마스가 다가오고 있었다.
 b. 호영이가 대호에게 컴퓨터 게임을 선물로 주었다.
 b'. 대호에게 호영이가 컴퓨터 게임을 선물로 주었다.
 c. (호영이가) 대호에게 게임 방법을 가르쳐 주었다.

- c'. (대호가) 호영에게 게임 방법을 물었다.
d. 쉽고 재미있는 게임이었다.
8. a. 주말에 졸업식이 있었다.
b. 수진이가 민영이를 식사에 초대했다.
b'. 민영이를 수진이가 식사에 초대했다.
c. (수진이가) 민영이의 졸업을 축하해주고 싶었다.
c'. (민영이가) 수진이의 초대에 기꺼이 응했다.
d. 졸업 후 계획에 관해 이야기를 나누었다.
9. a. 학교에서 바둑 대회가 열렸다.
b. 상호가 창현이를 접전 끝에 이겼다.
b'. 창현이를 상호가 접전 끝에 이겼다.
c. (상호가) 창현이보다 전략이 우수했다.
c'. (창현이가) 상호보다 전략이 약했다
d. 곧 결승전이 있을 예정이었다.
10. a. 겨울 방학이 시작되었다.
b. 경희가 소영에게 플로리다에서 엽서를 보냈다.
b'. 소영에게 경희가 플로리다에서 엽서를 보냈다.
c. (경희가) 소영이도 올 수 있길 바랐다.
c'. (소영이가) 경희를 부러워했다.
d. 플로리다는 겨울에 가기 좋은 장소 중 하나이다.
11. a. 아이들의 피아노 연주회가 열렸다.
b. 재환이가 호성이를 열렬히 환호했다.
b'. 호성이를 재환이가 열렬히 환호했다.
c. (재환이가) 호성이의 연주 후 크게 박수를 쳤다.
c'. (호성이가) 재환이에게 고마워하며 손을 흔들었다.
d. 아이들 모두 훌륭한 연주를 했다.
12. a. 이사 후 집들이 잔치가 막 끝났다.
b. 주영이가 은혜에게 설거지를 부탁했다.
b'. 은혜에게 주영이가 설거지를 부탁했다.
c. (주영이가) 하루종일 은혜의 도움을 받았다.
c'. (은혜가) 주영이를 하루종일 도왔다.
d. 그릇이 산더미 처럼 쌓여 있었다.
13. a. 모두들 즐거운 여름방학을 보냈다.
b. 진성이가 재호에게 방학때 찍은 사진을 보여주었다.
b'. 재호에게 진성이가 방학때 찍은 사진을 보여주었다.
c. (진성이가) 재호에게 각각의 사진에 대해 설명해 주었다.
c'. (재호가) 진성이에게 어디에서 찍은 사진들인지 물었다.
d. 다른 친구들도 사진 구경을 하러 모였다.
14. a. 팀원 전체가 중요한 거래를 위해 일하고 있었다.
b. 효정이가 정은이에게 서류 검토를 부탁했다.
b'. 정은이에게 효정이가 서류 검토를 부탁했다.
c. 공교롭게도 (효정이가) 정은이에게 잘못된 서류를 보냈다.
c'. 공교롭게도 (정은이가) 효정에게 받은 서류를 잃어버렸다.
d. 거래를 위한 준비가 계획보다 늦어지게 되었다.
15. a. 새로운 백화점이 문을 열었다.
b. 성호가 기범이를 따라 백화점에 갔다.
b'. 기범이를 따라 성호가 백화점에 갔다.
c. (성호가) 기범이의 양복을 골라주었다.
c'. (기범이가) 성호의 도움을 받아 새 양복을 골랐다.

16. d. 중요한 면접이 있었다.
a. 새학기를 앞두고 많은 학생들이 이사를 했다.
b. 가영이가 진화를 도와 짐을 옮겼다.
b'. 진화를 도와 가영이가 도와 짐을 옮겼다.
c. (가영이가) 진화에게 가구를 어디에 놓을지 물었다.
c'. 이사 후 (진화가) 가영이에게 밥을 샀다.
d. 새 집이 넓어서 좋았다.
17. a. 회사에서 중요 기술이 유출되었다.
b. 철호가 재범에게 따졌다.
b'. 재범에게 철호가 따졌다.
c. (철호가) 이 일에 재범의 책임이 있다고 믿었다.
c'. (재범이가) 이 일에 철호의 책임이 있다고 소문을 냈다.
d. 회사측에서 유출 경위를 조사중이었다.
18. a. 조용한 밤이었다.
b. 정아가 태연이에게 동화책을 읽어 주었다.
b'. 태연이에게 정아가 동화책을 읽어 주었다.
c. (정아가) 태연이의 자는 모습을 확인하고 불을 켜다.
c'. (태연이가) 정아의 무릎을 베고 잠들었다.
d. 다음날도 같은 동화책을 계속하여 함께 읽었다.
19. a. 지난주에 금연홍보 세미나가 열렸다.
b. 세미나 후 강호가 윤형이에게 담배를 끊길 권고했다.
b'. 세미나 후 윤형이에게 강호가 담배를 끊길 권고했다.
c. (강호가) 윤형이에게 얼마나 흡연이 해로운지 다시 설명했다.
c'. (윤형이가) 강호의 충고를 귀담아 듣지 않았다.
d. 금연은 말처럼 쉽지가 않다.
20. a. 학생들이 정류장에서 버스를 기다리고 있었다.
b. 소희가 성주에게 다가갔다.
b'. 성주에게 소희가 다가갔다.
c. (소희가) 성주에게 반갑게 인사했다
c'. (성주가) 소희에게 반갑게 인사했다
d. 버스를 기다리며 함께 이야기를 나누었다.
21. a. 강의가 매우 지겨웠다.
b. 승호가 태석이를 손가락으로 찔렀다.
b'. 태석이를 승호가 손가락으로 찔렀다.
c. (승호가) 태석이와 몰래 빠져나가고 싶었다.
c'. (태석이가) 졸다가 깨어 승호를 보았다.
d. 아직 강의가 마치려면 한참 남았었다.
22. a. 그룹 별로 과제가 주어졌다.
b. 현주가 은희에게 전화했다.
b'. 은희에게 현주가 전화했다.
c. (현주가) 은희에게 역할 분담을 가르쳐 주었다.
c'. (은희가) 현주에게 역할 분담을 물어보았다.
d. 각자 맡은 부분을 한 후 함께 모이기로 했다.
23. a. 새로 연 체육관에 유용한 프로그램이 많았다.
b. 석재가 태영이에게 요가 수업을 권했다.
b'. 태영이에게 석재가 요가 수업을 권했다.
c. (석재가) 태영에게 요가의 장점에 대해 설명했다.
c'. (태영이가) 석재에게 요가가 왜 좋은지 물었다.
d. 자세 교정에 도움이 된다고 한다.

24. a. 기숙사 방은 두 명이 같이 썼다.
 b. 은숙이가 세영이에게 청소를 하겠다고 약속했다.
 b'. 세영이에게 은숙이가 청소를 하겠다고 약속했다.
 c. (은숙이가) 세영이의 눈치가 보였다.
 c'. (세영이가) 은숙이에게 눈치를 주었다.
 d. 룸메이트와 잘 지내려면 배려가 필요하다.
25. a. 태권도 승단 심사가 있을 예정이었다.
 b. 태우가 재훈이를 열심히 지도했다.
 b'. 재훈이를 태우가 열심히 지도했다.
 c. (태우가) 노력하는 재훈이의 태도를 마음에 들어 했다.
 c'. (재훈이가) 자상한 태우의 말을 잘 들었다.
 d. 같이 땀 흘리며 즐겁게 연습했다.
26. a. 토요일이라 학교가 일찍 마쳤다.
 b. 서연이가 유진이를 공원에 데려갔다.
 b'. 유진이를 서연이가 공원에 데려갔다.
 c. (서연이가) 유진에게 솜사탕을 사 주었다.
 c'. (유진이가) 서연에게 솜사탕을 사 달라고 했다.
 d. 둘은 즐거운 시간을 보냈다.
27. a. 놀이터에서 아이들 장난이 한창이었다.
 b. 철수가 영호를 세게 할퀴었다.
 b'. 영호를 철수가 세게 할퀴었다.
 c. (철수가) 영호의 장난에 화가 나 있었다.
 c'. (영호가) 철수에게 먼저 시비를 걸었었다.
 d. 동네 아이들이 둘의 싸움을 말렸다.
28. a. 미술 시간이었다.
 b. 미란이가 현정이를 붓으로 간지럽혔다.
 b'. 현정이를 미란이가 붓으로 간지럽혔다.
 c. (미란이가) 심심해서 현정이에게 자꾸 장난을 걸었다.
 c'. (현정이가) 귀찮아서 미란이에게 짜증을 내었다.
 d. 선생님이 둘에게 주의를 주었다.
29. a. 밤 사이에 기숙사에 화재가 났다.
 b. 수동이가 준호를 불속에서 구했다.
 b'. 준호를 수동이가 불속에서 구했다.
 c. (수동이가) 빠져 나오다 준호를 발견했었다.
 c'. (준호가) 갇혀 있다가 수동이에게 구조되었었다.
 d. 불은 소방차가 도착한 후 곧 진화되었었다.
30. a. 수업이 끝나고 학생들이 교실에서 나왔다.
 b. 유진이가 소영이를 교실 앞에서 기다렸다.
 b'. 소영이를 유진이가 교실 앞에서 기다렸다.
 c. (유진이가) 소영이와 집에 같이 가고 싶었다.
 c'. (소영이가) 유진이에게 집에 같이 가자고 했었다.
 d. 집에 자주 같이 가곤 했다.
31. a. 아이들이 축구 경기를 하고 있었다.
 b. 경기중 상훈이가 영식이를 공격했다.
 b'. 경기중 영식이를 상훈이가 공격했다.
 c. (상훈이가) 영식이의 공을 가로채려 했다.
 c'. (영식이가) 상훈이의 공을 가로채려 했다.
 f. 매우 경쟁이 치열한 경기였다.

32. a. 아이들이 놀이터로 모여 들었다.
b. 은주가 미영이를 졸졸 따라갔다.
b'. 미영이를 은주가 졸졸 따라갔다.
c. (은주가) 언니 미영이가 가는 곳은 다 같이 가려 했다.
c'. (미영이가) 동생 은주를 어디든 잘 데리고 다녔다.
d. 해질녘까지 동네아이들과 놀았다.
33. a. 온 가족이 계곡으로 놀러 갔다.
b. 영호가 수동이를 물가로 살짝 밀었다.
b'. 수동이를 영호가 물가로 살짝 밀었다.
c. (영호가) 동생 수동이에게 장난이 심했다.
c'. (수동이가) 형 영호의 팔을 재빨리 붙잡았다.
d. 둘이 신나서 물놀이를 하였다.
34. a. 점심시간이 되었다.
b. 민정이가 현주를 잠시 찾아갔다.
b'. 현주를 민정이가 잠시 찾아갔다.
c. (민정이가) 현주에게 줄 것이 있었다.
c'. (현주가) 민정에게 줄 것이 있다고 했었다.
d. 둘은 모처럼 점심도 같이 먹었다.
35. a. 사냥 중에 사고가 있었다.
b. 준형이가 동호를 실수로 쏘았다.
b'. 동호를 준형이가 실수로 쏘았다.
c. (준형이가) 동호를 사슴으로 착각했다.
c'. (동호가) 준형이보다 앞서가다 사고를 당했다.
d. 안개가 짙어 앞을 보기 힘들었다.
36. a. 초등학교 동창회가 열렸다.
b. 연주가 혜영이에게 반갑게 인사했다.
b'. 혜영이에게 연주가 반갑게 인사했다.
c. (연주가) 혜영이의 안부를 궁금해 했었다.
c'. (혜영이가) 졸업 후 연주와 소식이 끊겼었다.
d. 모두들 지내온 이야기를 즐겁게 나눴다.
37. a. 신문에 어제 술집에서의 사고 기사가 실렸다.
b. 재훈이가 철수를 핫김에 죽였다.
b'. 철수를 재훈이가 핫김에 죽였다.
c. (재훈이가) 평소에 철수에게 앙심을 품었었다.
c'. (철수가) 평소에 재훈이의 원한을 샀었다.
d. 경찰이 사건을 수사중이다.
38. a. 방학이 시작되었다.
b. 정아가 경진이를 식사에 초대했다.
b'. 경진이를 정아가 식사에 초대했다.
c. (정아가) 평소에 경진이에게 고마운 것이 많았다.
c'. (경진이가) 평소에 정아에게 많은 도움을 주었다.
d. 먹을 것이 꾸집하였다.
39. a. 미술시간에 초상화 그리기를 하였다.
b. 기동이가 성민이를 정성껏 그렸다.
b'. 성민이를 기동이가 정성껏 그렸다.
c. (기동이가) 성민이에게 완성된 그림을 보여주었다.
c'. (성민이가) 기동이에게 완성된 그림을 보여달라고 하였다.
d. 초상화는 누구인지 알아보기 힘들었다.

40. a. 신입생 오리엔테이션이 열렸다.
b. 정은이가 선영이를 친절히 도와줬다.
b'. 선영이를 정은이가 친절히 도와줬다.
c. (정은이가) 새로 입학한 선영이에게 이것저것 설명해 주었다.
c'. (선영이가) 선배인 정은이에게 이것저것 물어보았다.
d. 신입생들은 대학생활에 대한 기대가 컸다.
41. a. 교실 안이 시끄러웠다.
b. 길동이가 오정이를 때렸다.
b'. 오정이를 길동이가 때렸다.
c. (길동이가) 오정이에게 약이 올라 있었다.
c'. (오정이가) 길동이를 자꾸 약올렸다.
d. 다른 아이들이 싸움을 말렸다.
42. a. 공휴일이라 수업이 없었다.
b. 지혜가 소영이에게 영화를 보여줬다.
b'. 소영이에게 지혜가 영화를 보여줬다.
c. (지혜가) 영화를 보여준다고 소영이와 약속했었다.
c'. (소영이가) 영화를 보여달라고 지혜에게 졸랐었다.
d. 영화가 기대 이상으로 재미있었다.
43. a. 곧 중간고사 기간이었다.
b. 재훈이가 우석이에게 수학을 가르쳐줬다.
b'. 우석이에게 재훈이가 수학을 가르쳐줬다.
c. (재훈이가) 우석을 돕고 싶었다.
c'. (우석이가) 재훈이에게 도움을 구했다.
d. 둘은 밤 늦게까지 같이 공부했다.
44. a. 이른 아침이었다.
b. 경미가 수영이를 흔들어 깨웠다.
b'. 수영이를 경미가 흔들어 깨웠다.
c. (경미가) 수영이와 운동을 하러 가고 싶었다.
c'. (수영이가) 경미와 운동을 하러 가기로 했었다.
d. 아침 공기가 상쾌했다.
45. a. 아침에 주차장이 소란스러웠다.
b. 정수가 인철이에게 거세게 항의했다.
b'. 인철이에게 정수가 거세게 항의했다.
c. (정수가) 인철에게 차 뒤가 받혔다.
c'. (인철이가) 정수의 차 뒤를 박았다.
d. 아파트 수위 아저씨가 다가왔다.
46. a. 친구들이 생일파티를 하러 모였다.
b. 가을이가 선영이에게 책을 선물했다.
b'. 선영이에게 가을이가 책을 선물했다.
c. (가을이가) 선영이에게 꼭 권하고 싶은 책이었다.
c'. (선영이가) 가을이에게 읽고 싶다고 말했던 책이었다.
d. 모두들 생일 축하 노래를 불러주었다.
47. a. 함박눈이 내려 아이들이 신이 났다.
b. 영식이가 정훈이에게 눈뭉치를 던졌다.
b'. 정훈이에게 영식이가 눈뭉치를 던졌다.
c. (영식이가) 정훈이를 숨어서 기다리고 있었다.
c'. (정훈이가) 영식이네 마당에 막 들어오던 참이었다.
d. 둘은 눈싸움을 시작했다.

48. a. 공항 탑승구에서 여행객들이 나오고 있었다.
 b. 서연이가 보경이를 반갑게 포옹했다.
 b'. 보경이를 서연이가 반갑게 포옹했다.
 c. (서연이가) 보경이에게 휴가를 같이 보내자고 초대했다.
 c'. (보경이가) 서연이와 휴가를 같이 보내러 놀러왔다.
 d. 오랜만에 만나 반갑게 이야기를 나누었다.

Materials for Experiment 5

1. a. 식당에서 현정의 생일파티가 있었다.
 a'. 식당에서 은주의 생일파티가 있었다.
 b. 현정이가 은주를 농담을 하며 웃겼다.
 b'. 은주를 현정이가 농담을 하며 웃겼다.
 c. (현정이가) 늘 심각한 편인데 d. 은주에게는 장난을 잘 쳤다.
 c'. (은주가) 늘 심각한 편인데 d'. 현정에게는 잘 웃어주었다.
- e. 생일에 온 모두들 즐거워했다.
2. a. 농구장에 태우의 모습이 보였다.
 a'. 농구장에 재훈이의 모습이 보였다.
 b. 태우가 재훈이를 지도했다.
 b'. 재훈이를 태우가 지도했다.
 c. (태우가) 언제나 성실하였고 d. 재훈이를 잘 돌봤다.
 c'. (재훈이가) 언제나 성실하였고 d'. 태우를 잘 따랐다.
- e. 농구 시합이 눈앞으로 다가왔다.
3. a. 토요일이라 서연이의 학교가 일찍 마쳤다.
 a'. 토요일이라 유진이의 학교가 일찍 마쳤다.
 b. 서연이가 유진이를 공원에 데려갔다.
 b'. 유진이를 서연이가 공원에 데려갔다.
 c. (서연이가) 목이 매우 말라서 d. 유진이에게 음료수를 마시자고 했다.
 c'. (유진이가) 목이 매우 말라서 d'. 서연이에게 음료수를 마시자고 했다.
- e. 유난히 무더운 날이었다.
4. a. 놀이터에서 철수의 장난이 한창이었다.
 a'. 놀이터에서 영호의 장난이 한창이었다.
 b. 철수가 영호를 세게 할퀴었다.
 b'. 영호를 철수가 세게 할퀴었다.
 c. (철수가) 모자를 쓰고 있었는데 d. 영호에 밀려 모자가 벗겨졌다.
 c'. (영호가) 모자를 쓰고 있었는데 d'. 철수에 밀려 모자가 벗겨졌다.
- e. 동네아이들이 모여들기 시작했다.
5. a. 졸업전에는 은정이네 동아리 친구들이 자주 모이곤 했다.
 a'. 졸업전에는 영희네 동아리 친구들이 자주 모이곤 했다.
 b. 은정이가 영희를 매우 그리워했다.
 b'. 영희를 은정이가 매우 그리워했다.
 c. (은정이가) 취업 준비에 바빠서 d. 영희와 만날 시간이 없었다.
 c'. (영희가) 취업 준비에 바빠서 d'. 은정이와 만날 시간이 없었다.
- e. 불황으로 취업이 특히 힘들때였다.
6. a. 밤사이에 수동이네 기숙사에 화재가 났다.
 a'. 밤사이에 준호네 기숙사에 화재가 났다.
 b. 수동이가 준호를 불속에서 구했다.
 b'. 준호를 수동이가 불속에서 구했다.
 c. (수동이가) 불길에 화상을 입었으나 d. 준호의 목숨을 구할 수 있어 기뻐했다.

- c'. (준호가) 불길에 화상을 입었으나 d'. 수동이 덕에 목숨을 건졌다.
e. 불은 소방차가 도착한 후 곧 진화되었다.
7. a. 모두들 미란이네 집에 미술 숙제를 하러 모였다.
a'. 모두들 현정이네 집에 미술 숙제를 하러 모였다.
b. 미란이가 현정이를 붓으로 간지럽혔다.
b'. 현정이를 미란이가 붓으로 간지럽혔다.
c. (미란이가) 그림을 다 그리고 d. 현정에게 자꾸 장난을 쳤다.
c'. (현정이가) 그림을 다 그리고 d'. 미란에게 복수를 하러 갔다.
e. 방 바닥에 물감이 튀었다.
8. a. 도별 축구대회가 상훈이네 학교에서 열렸다.
a'. 도별 축구대회가 영식이네 학교에서 열렸다.
b. 경기중상훈이가영식이를 공격했다.
b'. 경기중영식이를상훈이가 공격했다.
c. (상훈이가) 팀의 미드필더였는데 d. 영식의 공을 뺏고자 했다.
c'. (영식이가) 팀의 미드필더였는데 d'. 상훈의 공을 뺏으려 했다.
e. 매우 경쟁이 치열한 경기였다.
9. a. 이제 미영이의 마음이 한결 편해졌다.
a'. 이제 은정이의 마음이 한결 편해졌다.
b. 미영이가 은정이를 이미 용서했다.
b'. 은정이를 미영이가 이미 용서했다.
c. (미영이가) 승진을 한 후 d. 은정에게 너그러워졌다.
c'. (은정이가) 승진을 한 후 d'. 미영에게 말실수를 했었다.
e. 일이 잘 해결되어 다행이었다.
10. a. 형제가 많아서 영호네는 늘 시끄러웠다.
a'. 형제가 많아서 수동이네는 늘 시끄러웠다.
b. 영호가 수동이를 문쪽으로 밀었다.
b'. 수동이를 영호가 문쪽으로 밀었다.
c. (영호가) 형제들 중 막내였는데 d. 형인 수동에게 화가 나 있었다.
c'. (수동이가) 형제들 중 막내였는데 d'. 형인 영호에게 건방지게 굴었다.
e. 하루도 조용한 날이 없었다.
11. a. 카페에 윤정이의 모습이 보였다.
a'. 카페에 태희의 모습이 보였다.
b. 윤정이가 태희를 여러차례 설득했다.
b'. 태희를 윤정이가 여러차례 설득했다.
c. (윤정이가) 직장을 옮기고 싶어 d. 태희에게 취직을 부탁했다.
c'. (태희가) 직장을 옮기고 싶어 d'. 윤정에게 사직서를 제출했었다.
d. 대화가 꽤 길어졌다.
12. a. 사냥을 하다 준형에게 사고가 있었다.
a'. 사냥을 하다 동호에게 사고가 있었다.
b. 준형이가 동호를 실수로 쏘았다.
b'. 동호를 준형이가 실수로 쏘았다.
c. (준형이가) 멧돼지를 쫓아가다가 d. 동호에게 오발을 쏘았다.
c'. (동호가) 멧돼지를 쫓아가다가 d'. 준형에게 오발을 맞았다.
e. 짙은 안개로 주위가 잘 안보이는 날이었다.
13. a. 시간에 맞게 유진이의 버스가 정류장에 도착했다.
a'. 예정보다 늦게 소영이의 버스가 정류장에 도착했다.
b. 유진이가 소영이를 30 분 동안 기다렸다.
b'. 소영이를 유진이가 30 분 동안 기다렸다.
c. (유진이가) 전화를 걸어서 d. 소영에게 빨리 오라고 했다.

- c'. (소영이가) 전화를 걸어서 d'. 유진에게 미안하다고 했다.
e. 곧 소나기가 내릴 듯한 날씨였다.
14. a. 복도를 걷는 준호의 발걸음이 급해 보였다.
a'. 복도를 걷는 동현이의 발걸음이 급해 보였다.
b. 준호가 동현이를 뒤에서 잡았다.
b'. 동현이를 준호가 뒤에서 잡았다.
c. (준호가) 크게 소리를 지르며 d. 동현에게 화를 내었다.
c'. (동현이가) 크게 소리를 지르며 d'. 준호에게 화를 내었다.
e. 교실에 있던 아이들이 모여들었다.
15. a. 다양한 일어 실력의 학생들이 지영이네 반에 모여있었다.
a'. 다양한 일어 실력의 학생들이 서연이네 반에 모여있었다.
b. 지영이가 서연이를 잘 이해했다.
b'. 서연이를 지영이가 잘 이해했다.
c. (지영이가) 실력이 늘어서 이제는 d. 서연이와 대화할 수 있었다.
c'. (서연이가) 실력이 늘어서 이제는 d'. 지영과 대화할 수 있었다.
e. 요새는 많은 학생들이 일어 공부를 한다.
16. a. 신문에 재훈의 기사가 실렸다.
a'. 신문에 철수의 기사가 실렸다.
b. 재훈이가 철수를 핫김에 죽였다.
b'. 철수를 재훈이가 핫김에 죽였다.
c. (재훈이가) 술집 종업원이었는데 d. 철수와 싸움이 붙었다.
c'. (철수가) 술집 종업원이었는데 d'. 재훈이와 싸움이 붙었다.
e. 경찰이 사건을 수사중이다.
17. a. 이번 경력사원 모집은 현주네 회사에 중요한 일이었다.
a'. 이번 경력사원 모집은 지영에게 중요한 일이었다.
b. 현주가 지영이를 인터뷰에서 거절했다.
b'. 지영이를 현주가 인터뷰에서 거절했다.
c. (현주가) 기대하는 것이 많아서 d. 지영의 자질에 만족하지 못했다.
c'. (지영이가) 기대하는 것이 많아서 d'. 현주의 제안에 만족하지 못했다.
e. 다른 지원자들에 대한 인터뷰는 계속되었다.
18. a. 보건소에서 정수네 팀이 무료 봉사활동을 하고 있었다.
a'. 보건소에서 기동이네 마을 사람들이 무료 봉사활동을 받고 있었다.
b. 정수가 기동이를 정성껏 치료했다.
b'. 기동이를 정수가 정성껏 치료했다.
c. (정수가) 굴 한개를 꺼내서 d. 기동에게 웃으며 건네주었다.
c'. (기동이가) 굴 한개를 꺼내서 d'. 정수에게 웃으며 건네주었다.
e. 봉사활동은 저녁때까지 계속되었다.
19. a. 밤 사이 눈이 은주 발목까지 쌓였다.
a'. 밤 사이 눈이 미영이 발목까지 쌓였다.
b. 은주가 미영이를 바짝 따라갔다.
b'. 미영이를 은주가 바짝 따라갔다.
c. (은주가) 눈길에 미끄러져서 d. 미영이의 팔을 붙잡았다.
c'. (미영이가) 눈길에 미끄러져서 d'. 은주의 팔을 붙잡았다.
e. 운동장에는 이미 동네 아이들이 모여서 눈놀이가 한창이었다.
20. a. 초상화를 그리는게 기동에게 처음이었다.
a'. 초상화 모델이 되긴 성민에게 처음이었다.
b. 기동이가 성민이를 정성껏 그렸다.
b'. 성민이를 기동이가 정성껏 그렸다.
c. (기동이가) 자꾸 기침이 나서 d. 성민에게 잠시 쉬었다 하자고 말했다.

- c'. (성민이가) 자꾸 기침이 나서 d'. 기동에게 잠시 쉬었다 하자고 말했다.
 e. 완성된 초상화는 꽤 그럴듯 해 보였다.
21. a. 오랜만에 영희네 고등학교 동창회가 열렸다.
 a'. 오랜만에 민정네 고등학교 동창회가 열렸다.
 b. 영희가 민정을 유심히 관찰했다.
 b'. 민정을 영희가 유심히 관찰했다.
 c. (영희가) 들고 있던 컵을 내려놓고 d. 민정에게 말을 걸었다.
 c'. (민정이가) 들고 있던 컵을 내려놓고 d'. 영희에게 말을 걸었다.
 e. 학창시절 기억이 생생히 살아났다.
22. a. 잠시 후면 성민의 테니스 레슨 시간이었다.
 a'. 잠시 후면 상훈이의 테니스 레슨 시간이었다.
 b. 성민이가 상훈이를 집에 돌려보냈다.
 b'. 상훈이를 성민이가 집에 돌려보냈다.
 c. (성민이가) 배가 갑자기 아파서 d. 상훈에게 다음에 오라고 했다.
 c'. (상훈이가) 배가 갑자기 아파서 d'. 성민에게 다음에 온다고 했다.
 e. 테니스장은 주말이라 사람들이 많았다.
23. a. 점심 식사후 민정에게 약간의 여유가 있었다.
 a'. 점심 식사후 현주에게 약간의 여유가 있었다.
 b. 민정이가 현주를 잠시 방문했다.
 b'. 현주를 민정이가 잠시 방문했다.
 c. (민정이가) 커피 두잔을 사서 d. 한잔을 현주에게 건넸다.
 c'. (현주가) 커피 두잔을 사서 d'. 한잔을 민정에게 건넸다.
 e. 오후 직장인들로 커피숍이 붐볐다.
24. a. 잠복 근무를 하는 동현이의 눈빛이 날카로웠다.
 a'. 지명 수배중인 정수의 눈빛이 날카로웠다.
 b. 동현이가 정수를 몰래 미행했다.
 b'. 정수를 동현이가 몰래 미행했다.
 c. (동현이가) 몸집이 큰 편이었으나 d. 정수보다 행동은 민첩했다.
 c'. (정수가) 몸집이 큰 편이었으나 d'. 동현보다 행동은 민첩했다.
 e. 길은 가로등이 없어 꽤나 어두웠다.
25. a. 모교에서 연주네 동창회가 열렸다.
 a'. 모교에서 혜영네 동창회가 열렸다.
 b. 연주가 혜영에게 반갑게 인사했다.
 b'. 혜영에게 연주가 반갑게 인사했다.
 c. (연주가) 대화 중 급한 전화가 와서 d. 혜영보다 먼저 가야했다.
 c'. (혜영이가) 대화 중 급한 전화가 와서 d'. 연주보다 먼저 가야했다.
 e. 모두들 학창 시절 이야기를 즐겁게 나눴다.
26. a. 아이들이 길동네 집앞에서 싸우고 있었다.
 a'. 아이들이 오정네 집앞에서 싸우고 있었다.
 b. 길동이가 오정을 먼저 때렸다.
 b'. 오정을 길동이가 먼저 때렸다.
 c. (길동이가) 화를 참을 수가 없어서 d. 오정에게 달려들었다.
 c'. (오정이가) 화를 참을 수가 없어서 d'. 길동에게 달려들었다.
 e. 다른 아이들이 싸움을 말렸다.
27. a. 화학시간에 수정이의 발표가 있었다.
 a'. 화학시간에 민주의 발표가 있었다.
 b. 수정이가 민주에게 질문을 던졌다.
 b'. 민주에게 수정이가 질문을 던졌다.
 c. (수정이가) 화학 전공은 아니었으나 d. 민주보다 내용을 잘 이해하고 있었다.

- c'. (민주가) 화학 전공은 아니었으나 d'. 수정이보다 내용을 잘 이해하고 있었다.
e. 활발한 논의가 계속 되었다.
28. a. 오늘 승헌이네 봄방학이 시작되었다.
a'. 오늘 지섭이네 봄방학이 시작되었다.
b. 승헌이가 지섭에게 CD를 빌려줬다.
b'. 지섭에게 승헌이가 CD를 빌려줬다.
c. (승헌이가) 좋아하는 노래들이 있어서 d. 지섭에게 들려주고 싶었다.
c'. (지섭이가) 좋아하는 노래들이 있어서 d'. 승헌에게 빌려달라고 부탁했다.
e. 최신 유행곡들이었다.
29. a. 드디어 정아의 휴가가 시작되었다.
a'. 드디어 진경이의 휴가가 시작되었다.
b. 정아가 진경을 식사에 초대했다.
b'. 진경을 정아가 식사에 초대했다.
c. (정아가) 다이어트 중이라서 d. 진경에게 자기 몫의 디저트도 주었다.
c'. (진경이가) 다이어트 중이라서 d'. 정아에게 자기 몫의 디저트도 주었다.
e. 먹음직스러워보이는 초콜렛 케익이었다.
30. a. 곧 재훈이네 학교에 시험이 있었다.
a'. 곧 우빈이네 학교에 시험이 있었다.
b. 재훈이가 우빈이에게 수학을 가르쳐줬다.
b'. 우빈이에게 재훈이가 수학을 가르쳐줬다.
c. (재훈이가) 어제밤에 잠을 잘 못자서 d. 우빈이 몰래 하품을 했다.
c'. (우빈이가) 어제밤에 잠을 잘 못자서 d'. 재훈이 몰래 하품을 했다.
e. 시험 범위가 너무 많았다.
31. a. 날씨가 추워 정은이의 코가 빨갰다.
a'. 날씨가 추워 선영이의 코가 빨갰다.
b. 정은이가 선영이를 친절히 도와줬다.
b'. 선영이를 정은이가 친절히 도와줬다.
c. (정은이가) 학회 장소에 가다가 d. 선영에게 길을 가르쳐줬다.
c'. (선영이가) 학회 장소에 가다가 d'. 정은에게 길을 물어보았다.
e. 이른 아침 시간이었다.
32. a. 크리스마스가 되어 동건이와 친구들이 모였다.
a'. 크리스마스가 되어 준호와 친구들이 모였다.
b. 동건이가 준호를 일부러 피했다.
b'. 준호를 동건이가 일부러 피했다.
c. (동건이가) 여자 친구와 헤어진 후 d. 준호를 닮았다.
c'. (준호가) 여자 친구와 헤어진 후 d'. 동건을 닮았다.
e. 모임 분위기가 어색해졌다.
33. a. 곧 영순이네 시험기간이었다.
a'. 곧 진경이네 시험기간이었다.
b. 영순이가 도서관에 가는 길에 진경을 태워주었다.
b'. 진경을 도서관에 가는 길에 영순이가 태워주었다.
c. (영순이가) 우연히 옛 친구를 만나서 d. 진경에게 소개해 주었다.
c'. (진경이가) 우연히 옛 친구를 만나서 d'. 영순에게 소개해 주었다.
e. 도서관은 평소보다 사람들이 많았다.
34. a. 아침부터 정수의 표정이 안좋았다.
a'. 아침부터 인철의 표정이 안좋았다.
b. 정수가 인철에게 거세게 항의했다.
b'. 인철에게 정수가 거세게 항의했다.
c. (정수가) 2층에 살았는데 d. 위층에 사는 인철이의 소음이 견디기 힘들었다.

- c'. (인철이가) 2 층에 살았는데 d'. 아래층에 사는 정수에게 시끄럽다고 불평을 들었다.
e. 아파트의 방음 시설이 열악했다.
35. a. 토요일이라 지혜의 학교가 일찍 마쳤다.
a'. 토요일이라 소영이의 학교가 일찍 마쳤다.
b. 지혜가 소영이에게 영화를 보여줬다.
b'. 소영이에게 지혜가 영화를 보여줬다.
c. (지혜가) 중간에 잠이 와서 d. 소영이의 어깨에 기대어 잠들었다.
c'. (소영이가) 중간에 잠이 와서 d'. 지혜의 어깨에 기대어 잠들었다.
e. 영화가 너무 지루했다.
36. a. 이른 아침 승호의 알람시계가 울렸다.
a'. 이른 아침 인철이의 알람시계가 울렸다.
b. 승호가 인철이를 공방에 바래다 주었다.
b'. 인철이를 승호가 공방에 바래다 주었다.
c. (승호가) 주머니를 뒤지더니 d. 인철에게 나중에 먹으라며 떡을 건넸다.
c'. (인철이가) 주머니를 뒤지더니 d'. 승호에게 고맙다며 초콜렛을 건넸다.
e. 곧 출발시간이 되었다.
37. a. 체조대회가 보희네 학교에서 열렸다.
a'. 체조대회가 연아네 학교에서 열렸다.
b. 보희가 연습 중 연아를 방해했다.
b'. 연아를 연습 중 보희가 방해했다.
c. (보희가) 지난대회에서 준우승을 했는데 d. 연아에게 라이벌 의식을 느꼈다.
c'. (연아가) 지난대회에서 준우승을 했는데 d'. 보희에게 계속 견제를 받았다.
e. 올해 누가 우승을 할 지 아무도 확신할 수 없었다.
38. a. 첫눈이 오더니 영식이네 앞뜰에도 눈이 제법 쌓였다.
a'. 첫눈이 오더니 정훈이네 앞뜰에도 눈이 제법 쌓였다.
b. 영식이가 정훈에게 눈뭉치를 던졌다.
b'. 정훈에게 영식이가 눈뭉치를 던졌다.
c. (영식이가) 나무옆에 바짝 서서 d. 정훈이의 반격을 피했다.
c'. (정훈이가) 나무옆에 바짝 서서 d'. 영식이의 공격을 피했다.
e. 강아지들도 눈속에서 뛰놀고 있었다.
39. a. 늦게까지 야구경기를 보느라 수정이의 눈이 충혈되었다.
a'. 늦게까지 야구경기를 보느라 민아의 눈이 충혈되었다.
b. 수정이가 민아에게 오천원을 주었다.
b'. 민아에게 수정이가 오천원을 주었다.
c. (수정이가) 지갑에 돈이 얼마 없었는데 d. 불행히도 민아와의 내기에서 졌다.
c'. (민아가) 지갑에 돈이 얼마 없었는데 d'. 다행히도 수정이와의 내기에서 이겼다.
e. 이번 야구 월드컵에서는 한국이 준우승을 했다.
40. a. 놀이터에 선우와 친구들이 놀고 있었다.
a'. 놀이터에 인표와 친구들이 놀고 있었다.
b. 선우가 인표를 팔을 물었다.
b'. 인표를 선우가 팔을 물었다.
c. (선우가) 자기 장난감에 싫증이 나서 d. 인표의 장난감을 뺏으려 했다.
c'. (인표가) 자기 장난감에 싫증이 나서 d'. 선우의 장난감을 뺏으려 했다.
e. 장난감이 부서졌다.
41. a. 약속 장소에 들어오는 가을이의 모습이 보였다.
a'. 약속 장소에 들어오는 선영이의 모습이 보였다.
b. 가을이가 선영이에게 케익을 선물했다.
b'. 선영이에게 가을이가 케익을 선물했다.
c. (가을이가) 계속 바쁜 중에도 선영이를 위해 손수 만들었다.

- c'. (선영이가) 계속 바쁜 중에도 가을이를 많이 도와줬다.
e. 맛있는 딸기케익이었다.
42. a. 도서관에 덕수와 친구들이 있었다.
a'. 도서관에 경석이와 친구들이 있었다.
b. 덕수가 경석을 흔들어 깨웠다.
b'. 경석을 덕수가 흔들어 깨웠다.
c. (덕수가) 약속이 있어서 d. 경석에게 먼저 간다고 말했다.
c'. (경석이가) 약속이 있어서 d'. 덕수에게 깨워달라고 말했다.
e. 곧 수업 시작을 알리는 종이 멀리서 울렸다.
43. a. 저녁때 보경이네 회사 회식이 있었다.
a'. 저녁때 주혜네 회사 회식이 있었다.
b. 보경이가 주혜를 의도적으로 따돌렸다.
b'. 주혜를 보경이가 의도적으로 따돌렸다.
c. (보경이가) 새 부서로 옮긴 후 d. 주혜에게 아이디어를 도용당했다.
c'. (주혜가) 새 부서로 옮긴 후 d'. 보경이의 아이디어를 도용했다.
f. 회사 내의 경쟁적인 분위기가 문제였다.
44. a. 편지 하나가 동현이에게서 왔다.
a'. 편지 하나가 길동이 앞으로 왔다.
b. 동현이가 길동이에게 답장을 썼다.
b'. 길동이에게 동현이가 답장을 썼다.
c. (동현이가) 군대에 간 후 d. 길동이에게 이미 여러차례 편지를 받았었다.
c'. (길동이가) 군대에 간 후 d'. 동현이에게 이미 여러차례 편지를 보냈었다.
e. 둘의 우정은 돈독했다.
45. a. 설레임으로 서연이의 마음이 들떠있었다.
a'. 설레임으로 보경이의 마음이 들떠있었다.
b. 서연이가 보경을 반갑게 포옹했다.
b'. 보경을 서연이가 반갑게 포옹했다.
c. (서연이가) 오랜 여행을 마치고 돌아와 d. 보경에게 그동안 여행담을 들려주었다.
c'. (보경이가) 오랜 여행을 마치고 돌아와 d'. 서연에게 그동안 여행담을 들려주었다.
e. 밤 늦게까지 이야기가 계속되었다.
46. a. 친구들이 재석이네서 놀고 있었다.
a'. 친구들이 준하네서 놀고 있었다.
b. 재석이가 준하를 팔을 꼬집었다.
b'. 준하를 재석이가 팔을 꼬집었다.
c. (재석이가) 과자에 욕심이 나서 d. 준하의 몫도 뺏으려 했다.
c'. (준하가) 과자에 욕심이 나서 d'. 재석의 몫도 뺏으려 했다.
e. 엄마가 오셔서 간식을 더 주셨다.
47. a. 오후에 선경이의 토론회가 있었다.
a'. 오후에 지선의 토론회가 있었다.
b. 선경이가 지선을 예상외로 압도했다.
b'. 지선을 선경이가 예상외로 압도했다.
c. (선경이가) 공화당 후보였는데 d. 지선보다 논리가 강했다.
c'. (지선이가) 공화당 후보였는데 d'. 선경이보다 논리가 약했다.
e. 심도깊은 토론들이 오고갔다.
48. a. CCTV 에 호동이의 모습이 보였다.
a'. CCTV 에 희석이의 모습이 보였다.
b. 호동이가 희석을 발로 걷어찼다.
b'. 희석을 호동이가 발로 걷어찼다.
c. (호동이가) 감옥에 가기 싫어서 d. 희석에게서 도망치려 했다.

- c'. (회석이가) 감옥에 가기 싫어서 d'. 호동에게서 도망치려 했었다.
f. 격투가 이어졌다.

APPENDIX C

Cloze Test

For each blank in the following passage, please circle one of three options given. Please choose the option appropriate for the context. Please choose one option only for each blank.

Joe came home from work on Friday. It was payday, but he wasn't ____ (1) **even / more / ever** ____ excited about it. He knew that ____ (2) **then / when / while** ____ he sat down and paid his ____ (3) **checks / bills / salary** ____ and set aside money for groceries, ____ (4) **driving / pay / gas** ____ for the car and a small ____ (5) **deposit / withdrawal / money** ____ in his savings account, there wouldn't be ____ (6) **quite / not / too** ____ much left over for a good ____ (7) **pleasure / leisure / life** ____.

He thought about going out for ____ (8) **eat / dinner / eating** ____ at his favorite restaurant, but he ____ (9) **just / only / very** ____ wasn't in the mood. He wandered ____ (10) **around / at / in** ____ his apartment and ate a sandwich. ____ (11) **In / For / After** ____ a while, he couldn't stop himself ____ (12) **for / from / about** ____ worrying about the money situation. Finally, ____ (13) **he / she / it** ____ got into his car and started ____ (14) **drive / driven / driving** ____.

He didn't have a destination in ____ (15) **head / mind / fact** ____, but he knew that he wanted ____ (16) **be / to be / being** ____ far away from the city ____ (17) **which / there / where** ____ he lived. He turned onto a quiet country ____ (18) **road / house / air** ____. The country sights made him feel ____ (19) **as good / better / best** ____. His mind wandered as he drove ____ (20) **past / in / to** ____ small farms and he began to ____ (21) **try / think / imagine** ____ living on his own piece of ____ (22) **house / land / farm** ____ and becoming self-sufficient. It had always ____ (23) **being / been / be** ____ a dream of his, but he ____ (24) **having / have / had** ____ never done anything to make it ____ (25) **a / one / some** ____ reality. Even as he was thinking, ____ (26) **their / his / her** ____ logical side was scoffing at his ____ (27) **favorite / practical / impractical** ____ imaginings. He debated the advantages and ____ (28) **cons / disadvantages / problems** ____ of living in the country and ____ (29) **growing / breeding / building** ____ his own food. He imagined his ____ (30) **farmhouse / truck / tractor** ____ equipped with a solar energy panel ____ (31) **at / out / on** ____ the roof to heat the house ____ (32) **in / for / over** ____ winter and power a water heater. ____ (33) **She / He / They** ____ envisioned fields of vegetables for canning ____ (34) **either / and / but** ____ preserving to last through the winter. ____ (35) **Whether / Even / If** ____ the crops had a good yield, ____ (36) **maybe / possible / may** ____ he could sell the surplus and ____ (37) **store / save / buy** ____ some farming equipment with the extra ____ (38) **economy / cost / money** ____.

Suddenly, Joe stopped thinking and laughed ____ (39) **at / out / so** ____ loud, "I'm really going to go ____ (40) **through / away / in** ____ with this?"

Adapted from American Kernel Lessons: Advanced Students' Book. O'Neill, Cornelius and Washburn (1981).

Language Background Questionnaire

Sex: M/F _____ Age (in years) _____ Native country _____
 Years spent in the U.S. _____ Years spent in U.S schools _____ Dominant hand?: R / L

This questionnaire is designed to give us a better understanding of your experience learning a second language. We ask that you be as accurate and thorough as possible when answering the following questions. Thank-you for your participation in this study!

1) Please list all languages you know in order of dominance.

1. Language A	2. Language B	3. Language C	4. Language D

2) What is your first language (i.e. **language first spoken**)? If more than one, please briefly describe the situations in which each language was used.

3) Which language (if any) do you consider your second language?

4) If you have ever lived in or visited a country where languages other than your native language are spoken, please indicate below the name of the country (countries), the duration of the stay in number of months, and which languages you used while you were in the country (please indicate if you were spoken to in a language other than your first language, even if you never actually spoke that language)

<u>Country visited</u>	<u># Months there</u>	<u>Language(s) used</u>

5) How many years have you studied your second language? Please indicate the setting(s) in which you have had experience with the language (i.e. classroom, with friends, foreign country...)

<u>#of years</u>	<u>Setting(s)</u>

6) While you are (were) in an English-speaking community,

What percentage of the time do (did) you spend speaking your second language? _____%

What percentage of the time do (did) you spend speaking your first language? _____%

7) How much time did you spend speaking with native speakers of your second language?
hardly ever occasionally often at every opportunity

8) Please rate your second language reading proficiency on a ten-point scale.
(1= not literate, 10= very literate)

1	2	3	4	5	6	7	8	9	10
not literate								very literate	

9) Please rate your second language writing proficiency on a ten-point scale.
(1= not literate, 10= very literate)

1	2	3	4	5	6	7	8	9	10
not literate								very literate	

10) Please rate your second language conversational fluency on a ten-point scale.
(1= not fluent, 10= very fluent)

1	2	3	4	5	6	7	8	9	10
not fluent								very fluent	

11) Please rate your second language speech comprehension ability on a ten-point scale.
(1= unable to understand conversation, 10= perfectly able to understand conversation)

1	2	3	4	5	6	7	8	9	10
no comprehension								perfect comprehension	